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CONTENTS

The reports on the carrying capacity of the Blackwell's Island bridge, reprinted elsewhere in this issue, form the most valuable bridge document made public since the report on the failure of the Quebec bridge. The New York City Bridge Department is now engaged in carrying out the recommendations. This latest investigation was a direct result of the failure of the Quebec bridge. The two structures are similar, but there is a basic difference in the way they were designed. In the case of the Quebec bridge, expenses had to be kept down to the last cent, and the designers were forced to dispense with every possible pound of material. The result was a structure in which the margin of safety was cut too fine. But the Blackwell's Island bridge was built by a great city, to which an additional million dollars or so means relatively little, as compared with the safety and convenience of its citizens. Such municipal undertakings are in the nature of monuments; if built at all it is fitting that the construction be so massive and over-strong that there can never be any question of the possible load approaching the capacity of the bridge. The reports of Messrs. Boller & Hodge and of Professor Burr show that the bridge was originally designed with high unit stresses; a maximum load was assumed which would result in stresses closely approaching these limits, even without allowing for snow load and certain secondary stresses; and, finally, additional dead load was added without strengthening the main trusses, so that the bridge as built is not safe for loads considerably smaller than those for which it was planned. The responsibility for such conditions rests rather with a system than on any one of the engineers connected with the bridge. The original design was made by one administration and the carrying out of it left to a succeeding one. It may be assumed that if the original designer had been allowed to carry out his work, he would have modified his design to fit the new problems as they arose, and the outcome would have been entirely different, but since work extending over a number of years cannot so be carried out under our system of municipal government, it becomes still more clearly the duty of a designer of such a structure to take no chances, but to leave behind him administration-proof plans. The engineer who works out his possible stresses to the last detail, and then multiplies by three or four and makes his final design accordingly, is not always wasting money.

Within the past year the capacity of the express tracks of the New York city subway has been increased about 14 per cent. by rearranging the block sections at and near the stations so that trains can be run closer together; and by a speed-limiting device which has lately been introduced at the junction at Ninety-sixth street (on the southbound track from Van Cortland Park) trains are passed through that junction on an average in 23 seconds less time than before. The "average reader"—if the *Railroad Age Gazette* has any readers of that kind—may perhaps ask whether it is worth while to expend the money and care necessary to save such small bits of time; but that they are worth saving on the subway line is indicated by the fact that the sending of the Van Cortland trains through this junction closer together has disarranged the times—relative to the times of other trains coming from West Farms and alternating, south of Ninety-sixth street, with those first named—so that the time-table will have to be changed. The 14 per cent. increase is effected mainly by installing an additional signal at each station, so that a departing train clears the block signal next in rear of the entrance to the station when its rear car has passed the middle of the platform instead of requiring that car to pass completely out of the station before clearing the entrance signal. With this arrangement trains follow one another through the stations at intervals of 1¾ minutes, whereas the former minimum interval was two minutes. This means an increase from 30 trains (240 cars) an hour to 34 trains (272 cars) an hour. The block sections at the stations are arranged in this way, with short overlaps, on the assumption that the speeds of trains will be duly restricted, so that it shall never be impossible to stop a train at a stop signal; but to have the benefit of these short sections while still retaining the safeguard of the automatic stop, the speed-limit arrangement at Ninety-sixth street has been devised. With this, each home signal (and its accompanying automatic stop) are cleared for an approaching train, without hindrance by the overlap, provided the train has occupied a certain length of time in coming from the last preceding signal. For example, with four signals, A, B, C, D, 200 ft. apart, a train passing A at ordinary speed will be stopped by the trip, let us assume, at B; this because there is a train which holds in the stop position the home signal at C (and also the trip at B). But on passing A, and setting signal A in the stop position, the train closes a circuit which in, say, five seconds, pulls down the trip at B notwithstanding the presence of a train on the track between C and D. If, therefore, the train takes five seconds to travel the 200 ft. between A and B it will find

a clear signal and a clear "trip" at B. The next signal being equipped in the same way, the train may continue to follow the preceding train only one very short block behind it, as long as its speed is kept within the low rate prescribed.

The following list of speed records for one mile has lately been published:

Electric locomotive, 27 seconds, 1903
Automobile, 28½ seconds, 1906.
Steam locomotive, 32 seconds, 1893.
Motor-paced bicycle, 1 minute 6⅕ seconds, 1904.
Bicycle, unpaced, 1 minute 49⅗ seconds, 1904.
Running horse, 1 minute 35½ seconds, 1890.
Pacing horse, 1 minute 55 seconds, 1906.
Trotting horse, 1 minute 58½ seconds, 1905.
Man skating, 2 minutes, 36 seconds, 1896.
Man running, 4 minutes 12¾ seconds, 1887,
Man walking, 6 minutes 23 seconds, 1890.

As to the facts here shown we have no comment to make, except to observe that the steam locomotive run was made on a descending grade, and that the record of it (like all the steam locomotive records above 90 miles an hour that we can recall) was not made and vouched for in the careful and accurate way that is requisite in such a case. But a word should be said on one of the comments that has been published:

"It will be observed that the difference between the locomotive and the automobile is trifling. However, both the electric locomotive and the automobile may be expected to show further improvement, as their development is incomplete, while their steam brother has attained about the limit."

It is true that the *designers* of steam locomotives for use on railroads appear to have nearly reached the limit in building for speed; for they have used wheels 8 ft. in diameter (and in a few cases larger) and they have made boilers as big as they can find room for on the railroads of the country; but it does not follow that the locomotive has shown its best speed; for the attempt has never yet been fairly made. The largest wheels, the largest boiler and the lightest load have never yet been combined in a single trial, or, at least, no such performance has ever been published. The obvious reason for this is that railroads are built for business, not for sport. It would appear, however, that the automobile will have the final advantage, for with roadways furnished by the public or by nature, of unlimited width, it may keep its center of gravity so low as to be practically proof against overturning; while with elastic tires it can cope with shocks in a way that no practicable steel-track arrangement can approach to. One of the records not found in the list quoted is that made on the Long Island railroad June 30, 1899, when a man rode a bicycle immediately behind a passenger train and made a mile in 57⅘ seconds. The car made a vacuum in front of the rider. And, what is the record with a motor cycle?

RATES AND RESULTS OF OPERATION ON NEW SOUTH WALES GOVERNMENT ROADS.

Comparisons of the rates and results of operation of railroads in different countries are often vitiated by failure to take account of differences of conditions. To take the rates and results of operation of the New South Wales government railroads, for the year ended June 30, 1908, as shown by the recent report of the Chief Commissioner, and compare them with the charges, operations and earnings on the 66 times greater mileage of the railroads of the United States, probably would not be instructive. But a comparison of the New South Wales roads with an American road run under somewhat similar conditions may suggest useful inferences. The road that seems best to serve this purpose is the Missouri, Kansas & Texas. Its lines, like those of the New South Wales railroads, run mainly through a new country. Its mileage is 3,076 miles; theirs is 3,473 miles. Its gross earnings in the year ended June 30, 1908, were $23,283,670; theirs were $23,969,050. Its capitalization is $62,070 per mile; theirs is $63,806.

On first glance one might think that the New South Wales roads must be much better operated than the M. K. & T., for the M. K. & T. net operating income in the fiscal year 1908, was but $6,163,319, or 26½ per cent. of its gross earnings, while the net earnings of the New South Wales lines were $10,812,081, or 46.09 per cent. of their gross earnings. But the showing is not relatively so bad for the M. K. & T. as it seems, for while the New South Wales roads had no taxes to pay, the M. K. & T. paid in taxes during the year to the various states in which it runs $688,243. If it had not had this expense, its net operating income would have been $6,851,563, or 30 per cent. of its gross earnings.

The showing can be made better for the "Katy" by taking account of the relative densities of traffic and rates. In the following table the statistics for the Missouri, Kansas & Texas are from its pamphlet report for the year ended June 30, 1908, and those for the New South Wales lines are from the recent pamphlet report of the Chief Commissioner for the same year:

	New South Wales Lines.	Missouri, Kan. & Tex.
Total cost or capitalization	$221,564,877	$190,677,800
Total cost (or capitalization), per mile.	63,803	62,070
Tons carried	9,804,014	6,442,630
Total tons hauled one mile	617,642,314	1,524,135,814
Traffic, density per mile, tons	177,841	496,138
Average length of haul, miles	63	234
Average rate per ton per mile, cts.	2.04	1.01

The table shows why the "Katy's" operating ratio is higher than that of the new South Wales lines. It handled almost three times as much freight traffic per mile of line as the New South Wales roads and laid out only 20 per cent. more in operating expenses. The average rate per ton per mile that it charged in 1908 was 35 per cent. more than the average rate on all the railroads of the United States; but it was 50 per cent. less than the average rate on the New South Wales lines. The state-owned railroad made the more money. The percentage of its net earnings to its cost of construction was 4.88, while the percentage of the privately-owned road's net operating income to its capitalization after paying taxes was in 1908 but 3.2 per cent. But the privately owned road gave a great deal more and much cheaper service to the public. It is worth noting, also, that the "Katy's" capitalization per mile, although considerably higher than the average net capitalization per mile of all the railroads in the United States, is $736 per mile less than the cost of the New South Wales lines.

The impression that with operating expenses only 55 per cent. of gross earnings, the average freight rate of 2.04 cents on the New South Wales roads is altogether excessive will be confirmed by an inspection of the following table, the data in which is taken from the report of the Chief Commissioner for the year ended June 30, 1908:

Commodity.	Tonnage hauled— Total.	Per cent. of total.	Tons one mile.	Average haul miles.	Avg. rev. per ton per mile, cents.
Coal, coke and shale.	6,489,594	66.19	152,097,989	23.44	1.07
"A" Class*	493,724	5.04	51,922,518	105.16	2.04
Live stock	455,549	4.65	132,013,549	289.79	1.98
Miscellaneous†	419,586	4.28	31,365,290	74.75	1.50
Minerals.‡	356,642	3.64	18,156,353	50.91	1.58
Grain, flour, etc.§	300,384	3.06	67,556,806	224.90	0.73
Firewood	275,786	2.81	7,190,814	26.07	1.58
"B" class*	250,990	2.56	28,802,866	114.75	3.46
Hay, straw and chaff	192,419	1.96	36,037,952	187.29	.77
Wool class	126,384	1.29	36,232,214	286.68	4.00
Crude ores	117,271	1.20	10,871,640	92.71	1.07
1st class	109,441	1.12	15,122,851	138.18	6.22
2d class	91,886	.93	16,518,455	179.77	7.90
3d class	46,910	.48	7,064,143	150.59	9.78
Fruit	44,037	.45	4,342,411	98.61	1.78
"C" class	23,955	.24	1,219,376	50.90	4.08
Frozen & chld meats	7,635	.08	494,098	64.71	2.02
Gen'l g'ds in trk lds.	1,821	.02	632,989	347.60	5.25
Totals	9,804,014	100.00	617,642,314	63.00	2.04

* "A" and "B" classes consist of lime, vegetables, tobacco leaf, caustic soda and potash, cement, copper ingots, fat and tallow, water and mining plant, 6-ton lots; leather, 1 and 3-ton lots; agricultural implements in 5-ton lots; and other traffic of similar nature.
†I. e., timber, bark, firewood, drain-pipes, coal road metal in 6-ton lots, agricultural and vegetable seeds in 5-ton lots and traffic of a similar nature.
‡Other than coal, coke and shale.
§Up-journey.

It might be argued, before inspection of this table, that the high average rate per ton per mile on the New South Wales

roads was due to the short average haul per mile, which is but one-fourth as great as the average haul on the Missouri, Kansas & Texas, and less than one-half of the average haul on all the railroads of the United States. But the table is conclusive evidence to any American railroad man that the high average rate per ton-mile is the cause rather than the effect of the short average haul. No wonder the average haul of coal, coke and shale is only 23 miles when the average rate is 1.07 cents per ton per mile. Many hundreds of thousands of tons of coal are every year hauled in the United States for 3½ mills per ton per mile; and consequently coal moves distances here that would be impossible in any other country. Wool is one of the staple products of Australia; and yet the people of New South Wales have to pay their own government 4 cents per ton per mile to haul it to market, despite the fact that it moves an average distance of almost 300 miles. First-class articles moving an average of 138 miles pay 6 cents per ton per mile in New South Wales; second class moving 180 miles almost 8 cents per ton per mile; third class moving 150 miles, 9.78 cents. The report does not say what commodities these classes embrace; but the average hauls are decidedly long, which makes the rates unreasonably high according to American ideas.

W. M. Acworth mentioned in a recent address (*Railroad Age Gazette*, Sept. 18, 1908, p. 955) why it was impracticable for railroads to be built in Australia by private capital. If the New South Wales lines had been privately owned and operated from the start, it is hard to believe that the rates and results of operation on them would not to-day be very different. A private management, if we may judge by American experience would have tried the effect of lower rates upon the freight traffic, especially upon low grade commodities, and would have found that the result was a large increase in the business. The country would have benefited by the greater public service rendered and the roads would probably in the long run have enjoyed substantially higher earnings. Those who advocate government ownership of railroads in this country will hardly cite the report of the Chief Commissioner of the New South Wales government railroads as evidence of the advantages to be derived from public management.

THE DERAILMENT OF TENDERS.

There are few railroads which have not experienced serious trouble from derailed tenders, and this condition continues and is more pronounced with the large and high tanks used on modern locomotives, so that the subject is worthy of some special investigation and discussion. It is rather remarkable that the experience thus far in finding the cause and cure of tender derailments has not led to the adoption of more uniform standard practice but in many instances the diagnosis has not been correct and the cure has been due to a combination of several remedies and not always to the one particular change adopted. The knowledge relating both to cause and remedy is thus confused. Under such conditions it is difficult for mechanical officers to agree on a standard practice for the various details of tenders which are connected with their safe running. For this reason, also, a sovereign remedy will not here be proposed, but some of the principal causes of derailments will be described and some improvements in ordinary practice suggested.

The cause for derailments usually assigned at first is bad track, and this may be accepted as a contributing cause, for in most cases the tender might not have revealed its defects on first class track. The derailment may indicate a poor spot in the track, but the fact that freight cars with the most ordinary kind of trucks have passed over it safely can be taken as proof that something peculiar to the tender has caused it to leave the track, and a careful investigation will reveal the cause. Several differences between a box car and a tender in their track relations are unfavorable to the tender in respect to derailment. The tender is very short, the distance between center plates being 13 to 16 ft., while on the box car it is 30 ft., or about twice that on the tender, and this short wheel base in various ways makes it harder for the tender to stay on rough track. The couplings of the tender, both front and back, are as a rule more rigid than those of a car, and this is doubtless a frequent cause of derailment, often unsuspected. The relation of the load on the two tender trucks is quite variable, the rear truck carrying the larger part of the load, while in a car the load is evenly distributed. The center of gravity of the load on the tender is high and the water portion is liable to shift violently, tending to raise the wheels on one side. The total load of a 50-ton car and of a large tender with full load of water and coal is about the same, 140,000 lbs.

So far as the body or tank portion of the tender is concerned, considerable improvement has been made by making it as wide as the cab, usually 10 ft., with a water bottom extending under the coal space. The weight of a cubic foot of water is about 38 per cent. greater than that of bituminous coal, and there is therefore an advantage in storing the water at the lowest point rather than the coal. Tests with a float in the water space have shown that the wave due to the surging of water in a locomotive tank may be as high as 10 or 12 in. when running at 40 miles per hour, and this action has been almost entirely eliminated by the use of longitudinal baffle plates extending fully two-thirds the length of the tank. By increasing the length of the tank as much as ordinary turntables and roundhouses will allow, in addition to the use of maximum width, large water capacity is obtained without increasing the height and the center of gravity of the load is kept low. Something can be done also for the same purpose, in the design of the bolsters, so that the body will rest low upon the trucks, the side sills coming down 2 or 3 in. below the top of the wheel.

The drawbar between engine and tender is often of a crude design and of rough workmanship, and, on account of its rigidity it is a frequent cause of derailment. This drawbar should be horizontal and flexible, for if it is not there will be a tendency to lift the tender, thus reducing the weight on the front truck and causing its derailment. When tenders are derailed on straight track it is frequently due to the driving wheels depressing the track irregularly, and if there is a soft spot in the track the excessive weight on the back driving wheels may cause a temporary depression so that the tender truck wheels following will climb the rail. This is especially true where rigid diamond trucks are used, and the case is aggravated by a rigid coupling. The interlocking of the couplers between the tender and the first car has caused derailments; so also have the chafing and locking of the buffers at the same point resulted in the rear tender truck leaving the rails.

Regarding the relation of tender trucks to derailments, there is the greatest diversity of opinion and of truck construction. It is safe to say that the best practice favors the use of pedestal trucks with equalizers for the tenders of high-speed passenger locomotives, and some roads prefer to use this type for all large locomotives, but it is also true that a number of the large trunk lines use diamond trucks under the tenders of locomotives for their fast express trains. The important point about a diamond truck in such service is to secure flexibility so there will be no tendency for the truck to tilt on rough track and raise a wheel from the rail, for there is then danger of its mounting the rail and leaving the track. The pedestal truck has the advantage in this respect in securing more perfect equalization. New trucks have caused derailment because the bolsters have been fitted roughly in their guides and they chafe and stick, causing a tilting action as effective in producing derailment as want of equalization. The general stiffness of new trucks roughly built has often caused derailment which would have discontinued after they were limbered up and the working points

had smoothed down to a bearing. In this way many have been deceived and have attributed the remedy to some change in the spread of side bearings or in the use or disuse of front side bearings.

The center plates and side bearings of tenders have an important influence upon their safety on the track, and there is nothing connected with the running gear of locomotives which appears to be so little understood or which has developed such a diversified practice. The investigation which is to be made this year by the Master Car Builders' Committee on Center Plates and Side Bearings should be followed up by the Master Mechanics' Association, and a committee should be appointed to report on the best designs of these details for locomotive tenders. The center plates of large tenders are usually too small and those having a spherical bearing are not well suited to a top heavy vehicle where there is considerable motion between the side bearings, and especially where there are no front side bearings. Steel tender bolsters with center plates case integral have very rough bearing surfaces and the bearing when new has such a small area that the unit pressure is excessive. The rough high spots chafe and cut and the friction thus produced prevents the free movement of the truck. These plates should be ground to a uniform bearing and well lubricated with graphite grease. It is the excessive friction of center plates and side bearings which has led to the disuse of side bearings on the front tender truck, and if these were properly designed there appears to be no good reason why a front tender truck should not have side bearings the same as a car. It is probable that the best center plate for a tender is one having flat bearing surface and a large diameter, or better still one having roller bearings of good design. With such a center plate, having little friction and carrying the bulk of the load, there can be no objection to the front side bearing.

In preparing this article we have endeavored to get the best opinions from locomotive builders and motive power officers, and have collated them so far as there is any general agreement. There is, however, such a diversity of opinion on some essential points that we hesitate to make positive statements and therefore suggest that the subject of tender derailments and the best design of center plates and side bearings should be carefully investigated by the Master Mechanics' Association. The conditions as above described certainly warrant such an investigation, and if properly made it must lead to a more uniform and improved practice in the construction of locomotive tenders.

ILLINOIS CENTRAL.

The Illinois Central, for twenty years ably operated as an independent property, with Stuyvesant Fish as President, has, during the past year, become definitely a member of the Harriman group of roads. E. H. Harriman was elected a director, notwithstanding the bitter opposition of Stuyvesant Fish, and Mr. Fish was ousted from the board and J. Ogden Armour now has his seat. Previous to gaining control of the Illinois Central, the Harriman roads formed two sides of a triangle, the apex being at San Francisco and the two legs extending to Omaha and to New Orleans. The Illinois Central now forms the base of this triangle and gives the Harriman roads a much-needed north and south line. The connection, however, is just as important to the Illinois Central, since it has gained a great volume of traffic from its connection with the Southern Pacific and the Union Pacific.

Equally important is the completion of the line to Birmingham, Ala., which connects with the Central of Georgia. Although the balance sheet of the Illinois Central does not show any stock of the Central of Georgia as owned on June 30, 1908, Mr. Harriman has gained control of a majority of the Central of Georgia stock, and has stated that this stock is held in the interest of the Illinois Central. The Central of Georgia operates a line of steamers from Savannah to New York, and the Southern Pacific operates a line from New Orleans to New York. It will be seen that the Harriman rail lines now, in a sense, compete with their own water lines, since freight may be shipped from San Francisco via the Southern Pacific to New Orleans, and from there north to New York either by steamer or by the Illinois Central—Central of Georgia connection. The great importance of these possible traffic arrangements to the Illinois Central is perfectly apparent. The extension to Birmingham was not completed until April of this year, so that the operating results for the fiscal year ended June 30, 1908, do not to any large extent reflect the influence of this new line on the earnings of the company.

Operating income does not show the results of the general business depression as plainly as might have been expected. The total operating income last year was $57,187,656, a decrease of a little less than 4 per cent., this decrease being greater in revenue from freight, which amounted to $35,357,811, or 7 per cent. less than the previous year, than in passenger revenue, which was $10,991,798 last year, or but a little less than 2 per cent. under the revenues of the preceding year.

It was the inability of the company to reduce operating expenses in anything like the same way that the volume of business was reduced that makes the most unfavorable feature of the annual report. The operating expenses were $41,580,354 last year, this being an increase of 2 per cent. over the previous year, and absorbing 72.7 per cent. of income this year, as against 68.5 per cent. in the previous year. Part of these increased expenses came from hire of equipment incident to the greater number of foreign cars handled and to advanced rate of pay for wages.

Maintenance of way cost $6,758,173 last year, as compared with $7,000,460 in the previous year. This is an average of $1,497 in 1908 and $1,568 in 1907 spent per mile of road operated. The sum for 1908, however, does not include repairs and renewals of work equipment.

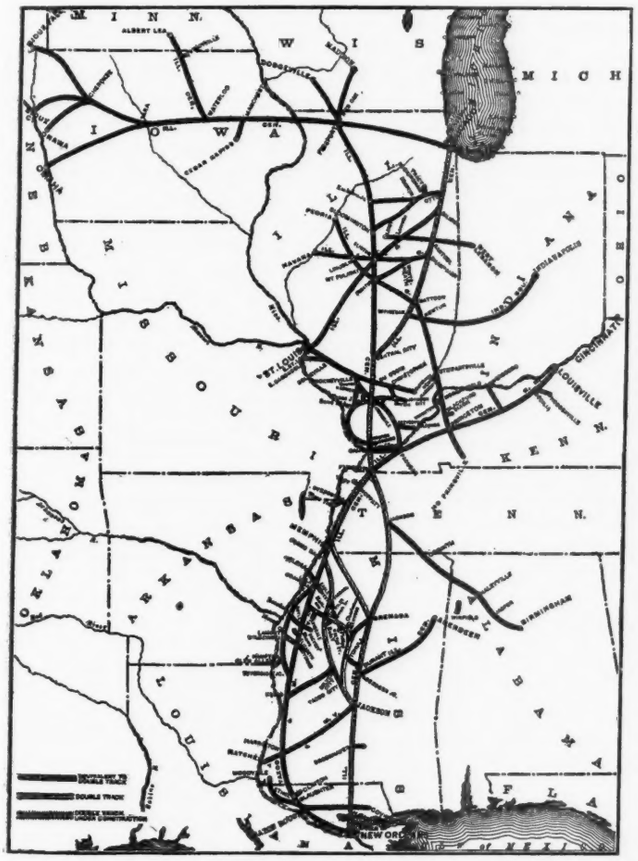
The unit costs of repairs and renewals of equipment for 1908 and 1907 were as follows: Per locomotive, $2,424, as against $2,122; per passenger car, $798, as against $775, and per freight and work train car, $80, as against $91. These are ample expenditures, and the decrease in expenditure per freight and work train car is because the expenditure in 1907 was extraordinarily high, the expenditure for this account being about $67 in 1906. The average age of locomotives owned is 12.32 years. This compares with 11.86 years, the average age in 1907.

There have been $30,000,000 first lien equipment 4 per cent. bonds issued during the year, but this entire amount is held in the treasury. On May 18, 1908, stockholders voted to increase the capital stock by a new issue of $28,512,000, thus making the total capital stock $123,552,000. One-half of the new stock was issued at par to stockholders and the remaining half was held in the company's treasury. The first substantial payment on this stock was made July 7, 1908, so that the balance sheet as of June 30 does not show hardly any gain on the asset side from the sale of stock. Cash on hand amounted to $1,589,724, being only a slight increase over the previous year and showing the necessity for the sale of securities by the company. There was an increase of $8,000,000 in loans and bills payable and of current liabilities, this sum totaling $8,400,000 on June 30, and an increase of over $5,000,000 in loans and bills payable under deferred assets, the total under this head being $15,190,000 on June 30, 1908. Since the close of the fiscal year the directors have authorized an issue of $110,000,000 refunding mortgage 4 per cent. bonds, and have sold $20,000,000 of these bonds to Kuhn, Loeb & Co., New York, at a price said to have been around 95. An additional $10,000,000 may be issued to buy the property of the Indianapolis Southern. Cash from this sale can be used

to pay off the loans and bills payable and give the company a working capital more commensurate with the business done than it had on June 30.

The Memphis & State Line Railroad was purchased during the year and its costs of construction, $2,225,864, was transferred from account of other railroads to cost of road and equipment, and the passenger station, Stuyvesant docks and Harahan yard at New Orleans were bought from the Yazoo & Mississippi Valley at a cost of $4,922,276, this sum being charged to cost of road and equipment.

General figures of operating results simply strengthen the assertion that the Illinois Central was unable to cut down expenses in proportion to the decrease in traffic. Expenses per revenue train-mile were $1.44 last year, an increase of about 7 per cent., while the excess of income over expenses per revenue train-mile decreased nearly 13 per cent. The tonnage



Illinois Central.

of revenue freight carried amounted to 25,047,062 tons, a decrease of 7 per cent. from the previous year, and the number of tons of revenue freight carried one mile decreased by over 8 per cent., the average revenue per ton-mile increasing by less than 2 per cent. and amounting to 0.586 cents last year. Both the number of passengers carried and the average distance each passenger was carried increased, the former figure being 23,357,184, a less than 1 per cent. increase, and the average distance carried being 25.34 miles, an increase of over 4 per cent.; but the revenue per passenger per mile amounted to only 1.857 cents last year, a decrease of over 5 per cent. The statement of Mr. Harahan that part of the increase in expenses came from the increased wages is borne out by the fact that the average amount spent for wages of enginemen per mile increased from 7.79 to 8.26 cents.

The operation of the Tennessee Central was found to be unprofitable by the Illinois Central, and it was turned over to its stockholders during the year.

The following table shows the results of operation for the last two years, the figures for 1907 having been rearranged to correspond to the form prescribed by the Interstate Commerce Commission.

	1908.	1907.
Average miles operated	4,420	4,371
Freight revenue	$35,357,811	$38,033,271
Passenger revenue	10,991,798	11,187,233
Total operating revenue	57,187,656	59,528,097
Maint. of way and structures	6,758,173	7,000,467
Maintenance of equipment	9,310,136	9,381,106
Traffic	1,207,476	1,274,573
Transportation	19,489,220	19,214,773
Total operating expenses	41,580,354	40,765,171
Taxes	2,190,173	2,217,818
Net operating revenue	13,417,129	16,545,108
Gross income	15,775,644	19,363,683
Net income	7,996,399	11,687,091
Dividends	6,652,800	6,652,800
Improvements	.....	3,794,987
Replacement of equipment	1,046,963	192,947
Surplus	296,636	1,046,357

ERIE.

The Erie has passed through the most critical year in the history of the present company, organized 13 years ago. The financial difficulties, which became more and more pressing were met in a manner dramatic to a degree. There were $5,500,000 discount notes issued in April, 1907, and falling due April 8, 1908. The directors authorized an issue of $15,000,000 three-year collateral notes, $5,500,000 of which were to be exchanged at par for the same amount of discount notes, but on the day the discount notes fell due, a proportion of the holders refused to accept collateral notes in exchange. Then, almost in the hour of receivership, E. H. Harriman announced that he would take the $5,500,000 collateral notes, paying cash for them, and in this way the company was able to pay cash to holders of the discount notes.

The problem of the Erie has been one of finance even more than one of traffic, and in a bad bond market the company, with its impaired credit, stood a small chance to sell its securities at anything but ruinous figures, although the road was in need of expensive additions and betterments. At the beginning of the fiscal year ended June 30, 1908, the company had plans for work to make over the property into an efficient trunk line railroad. A new through line was being built to take the place of 70 of the first 89 miles westward out of Jersey City, and new cut-offs were being built further west. Grades and curves, now severe, were to be greatly reduced all the way between New York and Chicago, and for these improvements and additions the company needed money. Work was under way on most of the improvements, but it was evident that unless some plan could be devised for raising money, this work would have to be delayed or stopped entirely.

Dividends were declared in scrip in 1907, but the Public Service Commission of New York refused to permit the payment of this scrip dividend, so that dividends have been entirely discontinued during the past year, permitting the use of the company's earnings without lien, for expenses of operation and improvements to the property. This was not considered sufficient, and the highly ingenious plan of borrowing money to pay the interest coupons maturing on July 1, 1908, up to and including those maturing on January 1, 1909, was devised. J. P. Morgan & Co., New York, are buying these coupons, keeping the road a few feet above insolvency, and are depositing them as collateral for the $15,000,000 notes which were authorized in March, and of which Mr. Harriman bought $5,500,000. These coupons aggregate $4,898,755, this amount representing a loan of J. P. Morgan & Co. to the Erie. The money which would otherwise be paid as interest is being used to carry on the construction of new lines and cut-offs.

The most important of these projects are the Bergen Hill cut from Jersey City west, which was described in the *Railroad Gazette*, of May 15, 1908, and the construction of the Erie & Jersey from Highland Mills, N. Y., west via Campbell

Hall to Guymard, about 42 miles. This low grade double track line known as the Guymard Cut-Off is now almost completed and is expected to be in operation by the first of the year. It was described in the *Railroad Age Gazette* of November 6. The new line takes the place of a road with heavy grades and curvature. There is also a cut-off between Hunts, on the Hornell-Buffalo line, and Cuba, on the main line west of Howell, on which work is now being pushed.

The annual report of the Erie for the fiscal year ended June 30, 1908, brings home more clearly the changes in accounting methods brought about by the order of the Interstate Commerce Commission than could any appealingly written protest of the roads of this country. No attempt has been made to rearrange 1907 figures, so that wherever comparisons are made in this review they are liable to inaccuracies because of changed method of accounting. There is a table on page 48 of the annual report giving an analysis of the traffic revenue and expenses for the year, and comparing figures for such items as are *not* affected by the changes in classification. There are 34 items giving the information ordinarily published by a railroad company, such as the number of tons of general freight carried; average number of tons of freight in each train, etc. Of these items but eight are not affected by the new classification, and of these eight, average miles operated, number of tons of coal carried, and the figures that relate to the number of passengers carried, make up the total.

A comparison of income accounts given in the table at the end of this review shows the Erie suffering severely from the general business depression. Whether the figures are directly comparable or not, the general impression gained from the fact that in 1907 the Erie had a surplus of well over a million dollars, after paying dividends amounting to $2,500,000, and a deficit last year of over $2,000,000, with no dividends paid, is correct.

The general freight revenue suffered more than the revenue from coal and from passengers, the decrease being about 20 per cent., so that revenue from general freight amounted to but $20,009,171 last year; both the coal and passenger revenue remaining about the same. The revenue per freight train mile was $2.79 last year as compared with $2.90 in the previous year, and the average train load of revenue freight was 464 tons as compared with 472 tons. The passenger revenue for the year was $9,489,449, an increase of less than 1 per cent. over the previous year, and the average fare received from each passenger per mile was 1.484 cents, an increase of about half of one per cent.

Expenses amounted to $39,977,497, an increase of nine per cent. This is in part due to an increase in transportation expenses, and in part to more money having been spent for maintenance of way and structures and maintenance of equipment. Maintenance of way cost $2,723 per mile of road operated as compared with $2,346 in 1907. Beside this, there was spent $2,019,350 for additions and betterments to the road, including the development of coal properties, elimination of grade crossings, additional track and sidings, etc. This sum was charged to capital account. Of the total operating expenses, 54 per cent., or $22,338,924, was paid direct to labor and distributed among 38,403 employees last year. This compares with 59 per cent., or $22,475,372, paid to 38,396 employees in the previous year.

Possibly no figure shows better the increase in expenses of operation than the total cost per locomotive mile, which was 44.34 cents in 1908 as against 34.31 cents in the previous year, an increase of 29 per cent. The most noticeable increase is in cost for repairs and renewals, which amounted to 16.68 cents per locomotive mile last year as compared with 8.90 cents in 1907.

The unit costs of repairs and renewals of equipment in the last two years apparently compare as follows: $3,635 per locomotive, against $2,291; $500 per passenger train car against $612, and $55 per freight train car against $69. These are liberal expenditures, and it is evident that the management of the road is making an effort to put it in first class condition, regardless of decreased earnings. There were 34 locomotives added to the equipment and three old locomotives disposed of, so that the total number of locomotives at the end of the fiscal year was 1,415. Since December, 1895, there has been $41,209,615 spent for new equipment and charged to capital account, representing among other things the purchase of 492 locomotives, 15,500 box cars, 15,000 coal cars and 500 refrigerator cars.

The balance sheet shows cash on hand of $2,576,420. This compares with $6,517,499 on hand June 30, 1907. There are pay-roll accounts due of $1,744,781 and audited vouchers of $2,734,756. These accounts in themselves show but little change from the previous year, but taken in connection with the decrease in cash on hand, are far more formidable than in 1907.

Improvements which have been made and are under way all serve to strengthen the security of the general lien and general mortgage bonds, and it is expected that a plan will be shortly prepared for funding the coupons maturing on these bonds for a period long enough to enable the company to complete work now under way from its current funds.

It has been pointed out in previous reviews of annual reports of the Erie in these columns that in respect to classification of freight, the method used by the company is particularly to be commended. The number of tons of each commodity is given together with the per cent. of this tonnage to total tonnage carried; the increase, or decrease, of tonnage from the previous year and the per cent. of this increase or decrease. This is essential information about freight tonnage, but comparatively few railroads work out their figures in such detail. Anthracite coal, from the point of view of quantity, is the most important class of freight carried, its tonnage being 27 per cent. of the total tonnage last year as against 22 per cent. in the previous year. There were 9,059,591 tons of anthracite coal carried last year, an increase of 5 per cent. From the point of view of revenue the tonnage of merchandise is probably fully as important as any other item, the tonnage of this freight being 6.74 per cent. of the total tonnage last year as compared with 7.48 per cent. in the previous year. There were 2,265,978 tons carried, a decrease of 22.65 per cent. The Erie has as large, or larger, per cent. of merchandise tonnage as have most of the trunk roads. It received, however, last year but 0.06 cents per ton per mile on an average for its entire freight. This is an extremely low figure.

The effect of the opening of the tunnels under the Hudson river is shown by a decrease of 356,929 in the number of passengers carried by the Pavonia Ferry, but as yet the number of local passengers carried by the Erie has not changed enough to show any benefits derived from the improved facilities for getting from New York to the Erie terminals.

The following table gives the income account for the year 1908 and the year 1907. The figures for 1907 have not been rearranged to correspond to the new classification prescribed by the Interstate Commerce Commission, and the figures for the two years are not directly comparable, but are given for what they are worth.

	1908.	1907.
Average miles operated	2,171	2,168
Freight revenue	$20,009,171	$25,114,683
Coal revenue	13,937,170	13,435,409
Passenger revenue	9,489,449	9,458,282
Total operating revenue	50,007,603	53,914,827
Maint. way and structures	5,911,414	5,087,975
Maint. of equipment	10,654,742	8,147,536
Traffic	1,068,846	967,923
Transportation	17,793,522	18,107,485
Total operating expenses	39,977,497	36,724,241
Taxes	1,111,535	1,442,798
Net operating revenue	8,918,571	15,747,788
Gross income	11,669,038	17,950,413
Net income	*1,623,423	5,903,658
Additions and betterments	575,804	1,642,029
Dividends	.....	2,555,696
Surplus	†2,199,226	1,705,933

* Loss in 1908.
† Deficit in 1908.

NEW PUBLICATIONS.

Bridge Engineering; Roof Trusses. A Manual of Practical Instruction in the Calculation and Design of Structural Steel Truss and Girder Bridges for Railroads and Highways; Including also the Analysis and Design of Roof Trusses and Other Details of Mill Building Construction. By Frank O. Dufour, C.E., Assistant Professor of Civil Engineering, University of Illinois. Published by the American School of Correspondence, Chicago. 384 pages; 8vo; 340 illustrations; indexed; half-morocco. Price, $3.00.

This volume forms one of the series of handbooks which The American School of Correspondence has been issuing since shortly after its founding, and which have been noticed in these columns at different times. The object has been to create a series of practical working guides embodying the accumulated results of experience and the most approved modern practice along a great variety of lines—books that are especially adapted for self-instruction and home study.

This work by Professor Dufour has been officially adopted as a text-book at the University of Illinois, which is evidence of its value as a contribution to the literature of structural engineering. It seems well adapted for the general practical use of the engineer. The problems involved in the calculation and design of modern steel structures are satisfactorily covered in a volume of moderate proportions. The treatment is clear and concise, and free from abstruse mathematics. The section on Bridge Engineering treats fully both bridge analysis and bridge design, embracing the various types of truss and girder bridges, bridge piers and abutments, bearings and other details, for railroads, country highways, etc. Every detail is clearly explained by the aid of diagrams, while graphical methods are chiefly used in the computations. Photographs of representative bridges of the different types, gathered from different parts of this country and abroad, are shown in large number, adding greatly to the value and attractiveness of the text.

The same practical and concise treatment marks the section on roof trusses, which covers all details of the analysis, calculation, and design of the various types of roof trusses used for buildings of various spans, the methods of securing good light aand ventilation, the layout and other details of mills, shops, etc. Photographs of typical modern structures are shown, with full explanation of the methods followed in their design, and in some cases statements of cost. An analytical index is supplied, which increases greatly the value of the book as a work of reference.

The work throughout is eminently practical, taking up in a direct manner those problems which daily confront the practising architect concerned in the design of roof trusses, or the bridge builder designing members for various spans.

Letters to the Editor.

BEHAVIOR OF RAILS UNDER AN ENGINE.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

Some weeks since I had occasion to ride over a road having no passenger accommodations and rode on the front of the engine. It was an 18 x 26 cylinder Mogul engine. The track was laid with 52-lb. rail and was in fair condition as to line and gage, and very good as to surface, for a dirt-ballasted road. In the twenty miles which I rode over were three long grades of 1 per cent. Going up the first one, when the engine had nearly reached the top, my attention was attracted by a noise like a blow of a hammer against iron. Taking notice as it recurred, I found that the rail ahead of the engine would quiver an instant and then snap against the inner spikes, the tractive force of the engine seeming to pull the rail in. I observed as carefully as conditions would permit on the succeeding hills, and found that at each hill when the engine began to labor the same action occurred. It was less obvious when the engine had a fair speed than when it was near stalling, but it seemed to exist all the time.

May not this action, which I have never seen mentioned in print, explain some of our derailments? These often occur with no explainable cause, and may not this action, slight as is the possible rail movement, cause the engine to climb?

This action I have since observed on two other occasions, and would like to know if I have followed some phantom which has become so obsolete as to no longer attract attention, or if there is some merit in my observation?

ASSISTANT ENGINEER.

[The point to be considered here is whether the eye was not deceived. It requires a very quick eye to see such a phenomenon, and it is unsafe to trust to appearances.—EDITOR.]

ACCIDENT RECORD—CORRECTION.

The Yazoo & Mississippi Valley R.R. Co.,
Memphis, November 10, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I notice in your tabulated statement of accidents in September (November 6, page 1283) you show a derailment near Clarksdale, caused by low place in the track, in which four persons were killed, 26 injured. Where do you get such unreliable information? The derailment was caused by track buckling under the train in consequence of the excessive heat, this being the hottest day of the year. There were three, not four, persons killed.

J. F. PORTERFIELD,
Superintendent.

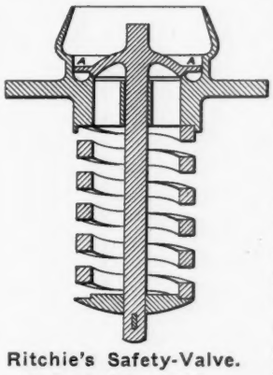
RITCHIE'S SAFETY-VALVE.

Binghamton, N. Y., November 7th, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

By a recent purchase I am enabled to send you a tracing from a dithographed circular issued by Charles Ritchie, engineer, of London, about the year 1856. This circular illustrates and describes several of Ritchie's improvements in steam boiler accessories, chief among them being a type of pop safety-valve, which was applied to his curious locomotive engine illustrated in the *Railroad Age Gazette* of August 28 last, page 815.

This valve was bolted to the top of the shallow dome on the barrel of the boiler, and was truly a lock-up valve for the spring, which hung below, could not be reached unless the valve was removed bodily. Ritchie designated this as a self-relieving safety-valve and described it as follows:



Ritchie's Safety-Valve.
Patented in 1848.

"Its peculiarity consists in having a compensation flange *A* around it, and this flange led vertically (but not exactly steam tight) into its seat to a depth proportioned to the diameter of the steam way (say ⅛). The object of this arrangement is that the steam may have an increased area to act upon the instant that the valve is moved from its seat. This will have the following effect, viz.: It will allow the steam to escape freely, and so give the boiler speedy relief. It will compensate for the increasing rigidity of the spring—when a spring is used. It will prevent a recoil of the valve, whether a spring or a weight be used, which recoil is like in effect to the blow of a heavy hammer under pressure of steam, and has doubtless been the cause that many a boiler has burst after the safety-valve was known to be up. It will lessen the duty of the engine-driver, increase public safety and will not cost more than the common valve. It may be provided with a locked cover, perforated for the escape of the steam."

This circular was evidently issued for advertising purposes, but, unlike modern advertisers, Ritchie omitted his address.

It is known, however, that he was in business in London about the year 1855-56.

I have not had time to look into the history of the safety-valve, but think this must be an early example embodying the principle of the modern pop valve. Ritchie's valve was patented in 1848.

HERBERT T. WALKER.

LOCOMOTIVE GRATE AREA.

56 Bd. Haussmann, Paris, October 6, 1908.

To the Editor of the Railroad Age Gazette:

I have read with considerable interest your editorial in the issue of September 18 on the subject of Locomotive Grate Area, and as your remarks are based in some measure on a paper of mine I should like to point out that the conclusions I have arrived at, differ quite a little from those that you derive from the tests under consideration. You say "In the Altoona tests, the smallest grate, one with an area of about 30 sq. ft. and burning 5,000 lbs. of coal per hour, or 166 sq. ft. of grate, showed a loss from unburned coal, principally sparks, of 29 per cent. of the coal fired with a boiler efficiency of 52.9. This large spark loss is due to the heavy blast required to burn coal at the rate given, the smokebox vacuum being about 6 in. The spark loss can be largely reduced by increasing the grate area."

My analysis of the Altoona tests shows that with the full sized grate of 55 sq. ft. the same rate of combustion of 5,000 lbs. of coal per hour gave practically the same loss by unburned coal. Although the rate of combustion per square foot of grate was reduced from 166 to 90 lbs. per hour the loss by the unburned coal was only reduced from 29.0 per cent. to 27.2 per cent. In other words, the tests seem to show that the loss by unburned coal is mainly dependent on the amount of coal burned per unit of firebox volume and is not greatly influenced by the amount of coal burned per square foot of grate area per hour. I am disposed to think that the loss by unburned coal is not principally due to the escape of the coal in the form of sparks, but is in fact chiefly due to the escape of unburned coal in the gaseous state. On this supposition the slightly greater loss with the smaller grate is explained by the greater resistance of the smaller grate to the passage of the air, so that with the smaller grate less air is admitted for the combustion of the same amount of coal, and consequently the combustion is necessarily less complete. An examination of the analysis of the gas bears out this view, for we find that when 5,000 lbs. of coal are fired per hour the air supply amounts to 11.4 lbs. of air per pound of coal fired on the large grate, while with the small grate only 9.7 lbs. of air per pound of coal are available. With the smaller grate the air passes through the fire with a greater linear velocity and thus will have a tendency to lift the smaller particles of coal from the grate, but if the volume of the firebox is the same in both cases the linear velocity of the gas through the box will be the same, and there will be no greater tendency in the one case than in the other to carry the solid coal out of the stack. The efficiency of the combustion in either case will be determined by the amount of air which can be gotten through the grate for each pound of coal fired, and by the space provided for the combination of the coal and the air. The combination will be the more complete, that is, the efficiency of the combustion will be the higher, in proportion as the volume of the combustion chamber is large and in proportion as the gas from the coal and the air for its combustion are intimately mixed together while maintained at a temperature at which combustion can take place. So far as I can read the Altoona and the St. Louis tests they point to the vital importance of a sufficient air supply and the necessity of sufficient volume for the proper combination of the gas and air. I agree with you that it is highly desirable that the firebox volume should be brought into consideration in discussing the design and operation of locomotive boilers. As indicating the line of thought which calls for development, it is perhaps useful to consider that with oil fuel the only grate area required is that which is sufficient to admit enough air for the combustion, while the firebox volume will determine the efficiency of the combustion. On the other hand if the fuel is anthracite coal a very considerable proportion of the combustion has to take place on the grate, and as this combustion requires time for its completion it is not practicable to burn more than a certain amount of coal per square foot of grate per hour. In this case where the fuel is for the greater part composed of fixed carbon the provision of sufficient grate area will of itself give sufficient volume for the relatively small amount of combustion which takes place above the grate. With a bituminous coal for fuel it is necessary to provide sufficient grate area to take care of the combustion, or at least of the preliminary combustion of the fixed carbon, and to allow of the entrance of sufficient air for the complete combustion; and at the same time it is necessary to have sufficient firebox volume to permit of the proper combustion of the volatile matter and of the secondary combustion of the fixed carbon. An experienced locomotive designer can readily proportion a boiler to give satisfactory results with a coal of any given composition, but it is to be hoped that the locomotive testing plants will gradually give to us further information which will make the determination of firebox volume a less empirical matter than it is at present.

A great deal can be learned from a study of the St. Louis tests, but these were all carried out with the same quality of coal. What is wanted is a series of tests similar to that made by the Geological Survey at St. Louis, but on a locomotive instead of a stationary boiler.

LAWFORD H. FRY.

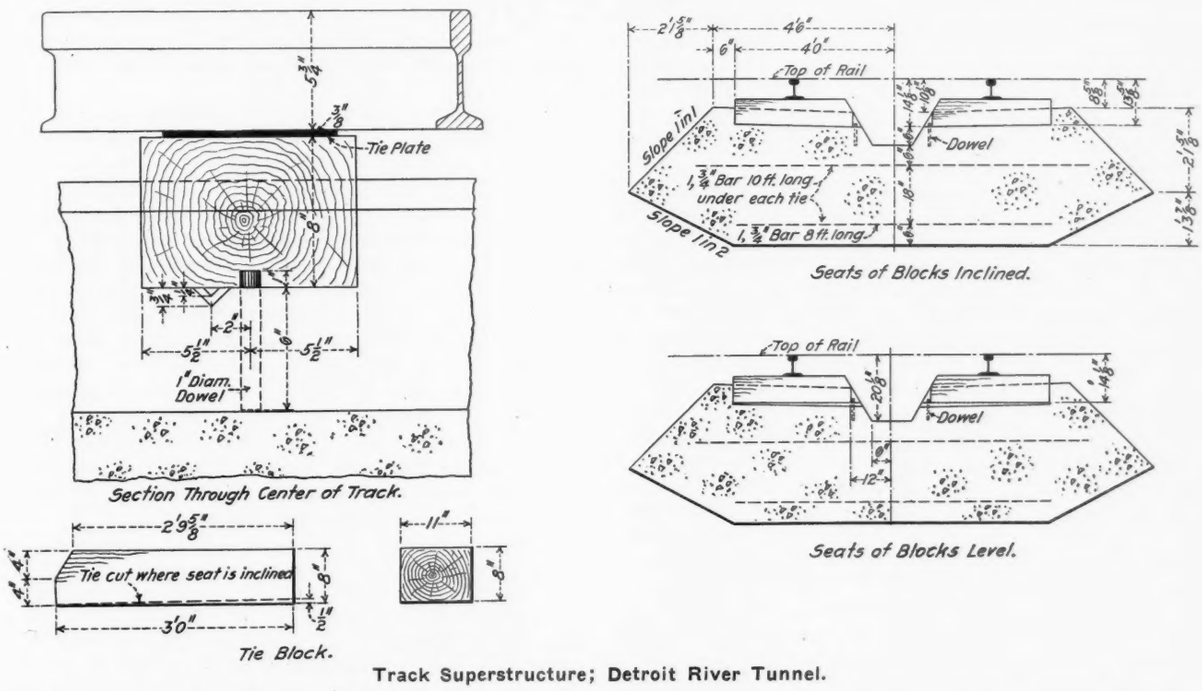
Contributed Papers.

DETROIT TUNNEL TRACK STRUCTURE.

In making the investigations resulting in the recommendation of the track superstructure proposed for the Pennsylvania tunnels on the New York extension, described in the *Railroad Age Gazette* of November 6, the committee in charge studied particularly the design adopted for the Detroit river tunnel of the Michigan Central. The accompanying drawings show the Detroit tunnel design. The plans for the tunnel as a whole were described, with illustrations, in the *Railroad Gazette* of February 16 and February 23, 1906. The accompanying photographs show part of a section of test track on the Toledo division of the Michigan Central, where the design has been tried in actual service for the last year.

The blocks are first quality white oak, 8 in. x 11 in. x 3ft. They rest directly on the concrete, fitting in recesses whose sides are vertical, and are spaced 24 in. apart on centers. The drawings show the shape and dimensions of the concrete mass used in the test track. It is a 1:3:6 mixture. In the tunnel, there will be five or six feet of concrete under the track; of this, 2 ft. will be a 1:2:4 mixture, and the rest 1:3:6. The concrete rests directly on a tough blue clay whose supporting power is from two to six tons per square foot. This is the same sort of clay as that in which the tunnel itself is laid. Several modifications of the design were tried. As shown in the drawings, in one case the seat of tie blocks is level, and under each one is a groove in the concrete ¼ in. to ¾ in. deep, sloping toward the center of the track for drainage. In the other case, the seat of the blocks is inclined, the blocks being cut accordingly, so that they slope toward the center of the track ½ in. in 3 ft. In both cases the surface of the concrete between ties slopes toward the center. It is

intended to clean the track by flushing it with water. The concrete is not water proofed, but the surface is a richer mixture than the rest. The photograph of finished track shows metal straps passing around the blocks and stepped into the concrete. These were put in to hold the block down and otherwise keep it in position. It was found, however, that there was no need for these, there being no tendency toward lifting the blocks, so they were removed, and now the only fastening



Track Superstructure; Detroit River Tunnel.

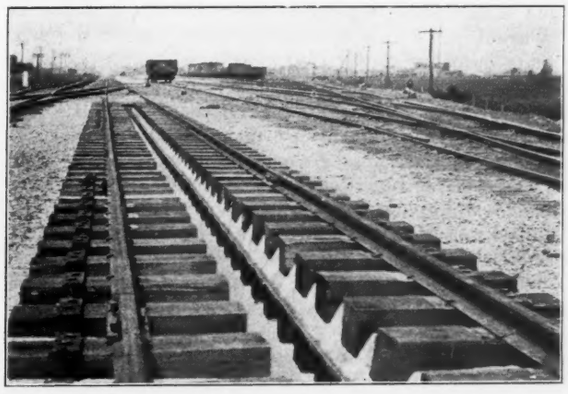
of the block is the dowel set against the inner end of it to prevent it from sliding inward. The blocks are made to fit tightly in the concrete. There have been other changes since the accompanying photographs were taken, one of them being that the inner ends of the blocks were beveled in accordance with the drawings. The blocks shown in the photograph are 8 in. x 8 in. Some of the blocks were put in place while the

Concrete Bed, Ready for Blocks.

concrete was wet, but the effect was the same as when they were laid after the concrete had set. Some were spaced 3 ft. apart on centers. No different results have been observed in this part of the track, but there is no intention of spacing the blocks more than 24 in. apart in the tunnel.

There are three sections of test track. Two of them, 150 ft. and 120 ft. long, respectively, are at the entrance to the yards at River Rouge; the third, 250 ft. long, is further south. The traffic at the entrance to the yards is heavy but slow, most of it being at not more than 10 miles an hour. The average daily traffic over these two sections of test track is 400 freight cars, average gross weight 44 tons, and seven passenger trains. The heaviest axle loads are those of six-wheel switch engines weighing 154,000 lbs. On the third section of track, the speed of trains is higher, running up to 40 miles an hour.

So far the track has been easy riding and otherwise satisfactory. The rails are 100-lb. section, which weight will be used in the tunnel. In the first installation a poor quality of rail was used, and the head of the rail got battered down at the joints. This resulted in heavy blows from the wheels at these points, and it was found that the concrete under the blocks was being slightly pulverised. Better rails were put in, and since then there has been no such trouble. The rail



Test Track; Detroit River Tunnel Design.

joints are ordinary angle bars. No tests to show the movement of the rail under load have been made by dynagraph or otherwise, but no deflection can be seen by the eye. The spikes are not driven quite home. No bad effects have been noticed on rolling stock nor on any part of the track structure. It is not observable that there is any more noise than in ballasted track, the only noticeable difference being a more resonant hum. Before it is installed in the tunnel, tests will be made

to find out whether in an enclosed space there is more noise than ordinary track.

We are indebted to W. J. Wilgus for information, photographs and drawings.

SOME FACTS ABOUT TRAIN DESPATCHING.

BY H. W. FORMAN.

Academic problems being frowned upon in the *Railroad Age Gazette* office, let me offer something from actual life. A few days ago I stepped into a despatcher's office not a thousand miles from St. Louis and, noticing the despatcher vainly trying to pull out what little hair he had left on his head, questioned him as to the nature of his present grief.

He replied: "If these trainmen do not actually lynch me when they get in, they will at least go before the commissioners and swear that I am insane and have me committed to an insane asylum. No 501, our limited train, was reported a few minutes late, on account of having to wait for a connection. Knowing that they could recover this time within 50 or 60 miles, I did not give any of it to freights, although 10 minutes of 501's time would have got two freights in here from B. When 501 was due to leave, I asked for another report and was told that it would be 20 minutes late. I ran it this much late and helped a few freights a little; but the two at B were down on the long track and by the time I could get this time to them (allowing for the time necessary for the crew to read the order and close switch), they would not have had time to make here for No. 501 and properly clear the run-late time; so I let them remain at B. When No. 501 was 20 minutes late I again inquired and was informed that it was thought the train would be at least 45 minutes late. I then got desperate and ran it 50 minutes late A to E, 45 minutes late E to K, 40 minutes late K to N, and 35 minutes late N to Z. After I had sent this long order to eight inferior trains and it had been delivered to three of them, operator at A advised me No. 501 would be only 35 minutes late. I knew if I delayed this train 15 minutes on a time order I would be censured, so I annulled the run-late order then out and issued another running No. 501 thirty minutes late. I had to stop two of the freights to take the former order away from them. When No. 501's connection arrived, there was an exceptionally heavy run of mail and baggage to transfer and, with some other work to be done about the train, it finally got started 55 minutes late. Who wants to be a train-despatcher under conditions of that kind?

"Why cannot a rule be made that will permit the original run-late order to stand? Why could we not run the train more or less late on it, instead of having to issue another long order every time the situation changes, as it generally does two or three times before trains finally get started? It took me 45 minutes to get out of this mess with No. 501 and there were trains waiting everywhere on me for other instructions, for Nos. 502 and 504 were also late."

I explained that while some such rule would undoubtedly lessen the work of despatchers, it would be an unsafe one, as train and enginemen would become so badly muddled in making their calculations that they would be pretty sure to get into trouble. Looking over his order-book I noticed he had No. 502 instructed to run three hours and thirty-five minutes late, while the train was actually three hours and fifty-two minutes behind time; and that No. 504 had orders to run fifty-five minutes late and seemed to be pinned down so closely that it was prevented from recovering any of the delayed time.

Then I said to him: "John, did it ever occur to you that train and enginemen also have their troubles in cases of this kind? They must add this run-late time to the time-table time of each of these trains in order to determine just how much time they have over superior trains, and it is difficult to keep all of these figures in one's mind. For instance, by the time they have ascertained how much time they have to run ahead of Nos. 502 and 504, quite likely they have forgotten their time against No. 501, this train being due at stations on odd minutes and their even run-late time having to be added to schedule time. Also, have you not read of collisions due to a miscalculation of an hour? Does it not impress you as being an unsafe system at best? A failure to accurately calculate the sum total of the two times by either the inferior or the superior train would result in trains meeting between stations. How would you like to move your trains by telephone and the block system, entirely doing away with formal orders and repetitions, as is done on the —— division?"

He answered: "I wish we had such a system, as I have worn out both of my arms to-day calling operators and changing long orders, and have accomplished nothing."

Not long after this I entered another despatching office and, although there were several late passenger trains, a president's special, yard engines and a half dozen freight trains to be kept moving, this despatcher seemed to be taking life easy. "It is just this way," he remarked: "we watch trains closely and tell operators which trains to hold, or to clear or to head in, and everything runs smoothly. We issue no train orders; instruct verbally. Trains are seldom delayed and when they are they are detained only about 12 minutes."

"But," I exclaimed, "don't you consider it unsafe to trust operators so far? Aren't they likely to misunderstand you, or clear trains from habit without consulting the despatcher? How long have you been using this system, and how many collisions have you had, chargeable to it?"

"No," he rejoined, "I do not regard it as unsafe. When a block is given to a train a red disk shows in the office at the other end of the block and this disk cannot be set back to clear without the co-operation of both operators. Were an operator to attempt to pull his block signal to clear, or caution, while the disk indicates 'block occupied,' a gong would ring in his office to warn him of his error. The system has been in use here about twenty years and during that time I think we have had accidents chargeable to this method of running trains which cost possibly $100, or $5 a year. There has been no loss of life.* May I ask you a question without seeming to be impertinent?"

"Certainly," I replied.

"What is the record on divisions where trains are moved by train orders, so far as accidents are concerned? Is the cost due to overlooking trains or errors respecting orders more than here, and are you making as good time with your trains as we are?"

I did not answer his query, but I did make some rapid mental calculations that staggered me.

FOREIGN RAILROAD NOTES.

Consul-General Richard Guenther of Frankfort reports that the management of the German railroads has ordered a higher [maximum] speed on the main lines, so that instead of 90 kilometers (55.92 miles), as heretofore, it will be 100 kilometers (62.13 miles) per hour.

According to the latest statistics, the average age of the locomotives in service on the various German railroads varies considerably. The 22,006 locomotives in service during 1905-6 had an average age of 12.8 years. Of these the locomotives of the Prussian-Hessian roads showed an average age of 11.1 years, those of the Saxon roads 18.3 years, those of the Bavarian roads 19.1 years. The Bavarian State Railroads have in operation 72 locomotives that have been in continuous service 45 years, the oldest of these dating back to the year 1853.

*Six miles; six block stations.

UNIT COSTS OF RAILROAD BUILDING.

The cost per mile of track relaid on the main lines of the Missouri district of the Chicago, Burlington & Quincy during the season of 1907 was $412.64. This cost includes unloading, relaying and jointing. To this should be added the cost of reloading old rail, engineering and superintendence, which brings the cost per mile for this work to $450.

The delay per train per day to each gang on this season's work was approximately 10 minutes. Had there been no trains at all, each man would have laid 35 lineal feet of track per day, and the cost per mile would have been reduced to $264; that is to say, every train that passed over the Brookfield division, for example, cost this company $9.85 for delays to its steel laying gangs only. This, in a way, accounts for the high cost of this work, there being an average of 15 trains per day.

The records for this year show that the efficiency of the American (or "hobo") and foreign labor is about in the proportion of five to three; that is, the labor resulting from a gang of 30 hoboes is about equal to that of 50 foreigners; also the work the former do is much more satisfactory. This is an important point in securing laborers for track work. These engineers found that the best results were obtained from a rail laying gang of 40 men. They try to avoid increasing them above this number.

SUMMARY OF STEEL RELAID IN THE MISSOURI DISTRICT—SEASON OF 1907.

Description.	Divisions, Brookfield.	Hannibal.	St. Joseph.	Kansas City terminals.	Total, 85-lb.	St. Joseph.	Centerville.	Grand total.
Track laid, lin. ft.	577,758	118,881	54,974	6,772	758,385	36,745	41,461	836,591
Weight of rail laid, lbs.	85	85	85	85	85	65	66	65, 66, 85
Weight of rail released, lbs.	75	66-75	65	75-85	75, 65, 85	60	60-66	.....
Average number of laborers daily	45	34	26	32	41	11	68	39
Average rate per day of laborers	$1.75	$1.75	$1.75	$1.75	$1.75	$1.60	$1.35	$1.62
Number of days worked by gang	561	132	57	8	758	62	23	843
Average number of feet laid daily	1,029	892	964	846	1,000	593	1,802	992
Average number of feet per man per day	22.8	26.4	37.0	16.0	24.4	54.0	26.5	25.4
Average daily cost	$80.99	$61.04	$44.72	$50.83	$78.40	$17.83	$78.66	$75.14
Average cost per track foot	0.078	0.068	0.046	0.060	0.078	0.030	0.043	0.076
Percentage of curved track	37	47	00	00	22	48	90	48
Percentage of delays	13	10	16	20	15	00	00	5
Average number of trains daily	15	14	7	33	15	4	4	8
Kind of ballast	Rock gravel.	Rock.	Brnt cly & cndr	Rock.	.....	Cinders.	Cinders.	.....

MR. SHONTS ON THE NEW YORK RAILROAD LAW.*

The steam railroad is, and from the nature of things must always be, the backbone of all transportation. The canal aids the railroad in our national development, but it cannot alone carry the burdens of commerce. The railroads carry traffic to the canals and haul it away from them. * * * What is the situation to-day respecting our American railroads? Does the daring spirit which inspired our pioneer railroad builders, the spirit which assumed the risk, conceived the processes and defied the obstacles which beset the laying of the wire across the sea and the rail across the plains still exist? Have we as much of that alert, resourceful and self-confident individualism, which has been our greatest national asset, to-day as formerly? Do the coffers of the 2,000,000 American investors in American railroad securities open as readily as in the past to provide the funds necessary to keep our railroad development abreast of our traffic requirements? No. * * * What is it that has taken the heart of our railroad managers—that has chilled their laudable ambitions, that has frightened away our financial support, that has shadowed our horizon on every side, that has made us cease to act and only wait? The answer is clear—it is the fear of Government operation of our roads through commissions which have no financial responsibility. The idea of operation through commissions is the illogical outcome of public measures at first preventive and justified, but which, with the swing of the pendulum, have become a dangerous interference in matters which have their private as well as public concern and which, if extended and continued, will portend disaster.

Going beyond necessary laws, which provide for wise regulation, the idea of physical operation of railroads by commissions has come into being, and therein lies the greatest danger which our country faces to-day. The danger is not in the commissions as they are now made up, but in the law itself; in the fear on the part of the investors in railroad securities that the management of their properties will be taken out of the trained hands which now direct them and placed in charge of men who know nothing about railroad operation and have no financial responsibility. Railroads have no business in politics, but if the present tendency is not checked they will ultimately be thrown into the hands of politicians and become their prey.

Who would think of operating the great steel works of the country, or any other line of industry involving less complicated features, through commissions? Yet the idea is just as rational as that of operation of railroads by commissions.

We have in New York state to-day practical operation of transportation lines by commission and I find that it is not generally understood that this situation really exists as an actuality. The New York Public Service law has placed its commissions (we have two, one for New York city and one for the rest of the state) practically in the shoes of the directors of the railroad corporations throughout the state and has given them complete control of the corporate affairs. The commissions may compel railroads to change or add to their structures, to change or add to the operations of trains, to change their rates, or to change the kind and quantity of rolling stock, their terminal facilities, motive power or any other property or device used. State regulation under such a statute is in effect state prohibition of new enterprise and state operation of existing railroads. What is the result? Transportation development in New York is not paralyzed—it is dead. This is not because of anything that the men who now constitute these commissions have done; they have been prudent, careful and honest, but the menace is in the law. We do not know who the next commission will be or what it will do. Some of the present commissioners themselves have talked of recommending such a change in the public service law as will remove those things which are dangerous and which act as an effective barrier to further development and leave in the law only those things which make for reasonable regulation. Until legitimate regulation is substituted for the physical operation which is now authorized there can be no railroad progress in New York or any other state which has analogous laws. Rather than see this anomalous condition become general and permanent I as a railroad man would prefer governmental ownership and operation of the railroads, dangerous as that would be to the maintenance of our liberties, because operation without ownership not only destroys the initiative by destroying the hope of reward to the individual officers and dries up the fountains of money supply, which are necessary to keep

* From an address by Theodore P. Shonts, president of the Chicago & Alton and an officer of the Interborough Rapid Transit Company of New York, before the Lakes to the Gulf Deep Waterway Association, at Chicago, October 9.

the railroad development abreast of the traffic requirements, but also because of the fact that the commissions which operate the railroads have no financial responsibility and are not held accountable for results.

There is now no scarcity of money. Milions of dollars are being loaned in New York every week at 1 per cent., but none of it is going into railroad securities or for railroad extensions. Do not misunderstand me! I believe in supervision or regulation by commission. I think that the welfare of the country and the welfare of the railroads demand the existence of such bodies and that they be clothed with powers sufficiently broad to enable them to effectually protect the public welfare, so that nothing I say herein is a reflection on the doctrine of regulation by commissions; but the danger lies in those sections of the laws which go beyond the point of regulation.

The solution of the problem of continuing railroad development and creating additional facilities which should now be under active construction rests in giving the railroads a square deal. That means a prohibition of all rate discrimination, but full and complete authority to fix their own rates, subject to review, and thus obtain, under normal conditions, a fair return on the investment. It also means the right under proper regulation to operate their own properties. That is all that is needed, but that is absolutely essential.

SHOP NOTES.

At the Los Angeles shops of the Southern Pacific a number of ingenious improvements have been made in pneumatic tools, and the methods of holding them, for staybolt and rivet work, which have resulted in a large reduction in the time and cost of firebox repairs.

There are always objections made to the use of the heavy

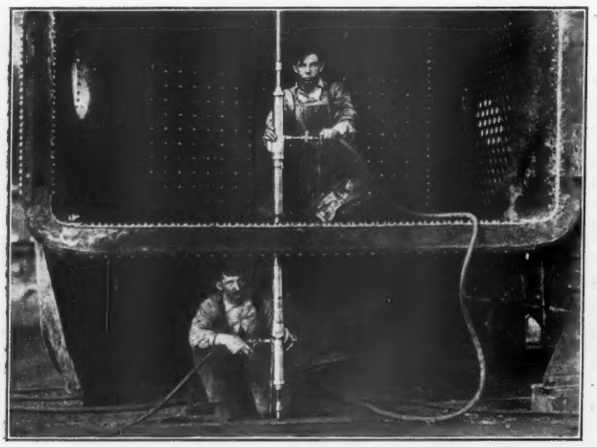


Fig. 1.

portable pneumatic hammers by the men required to use them, and the efforts have been directed to lessen their hardships in this particular. The staybolt driver shown in Fig. 1 uses the barrel portion of a pneumatic hammer and the attachment containing a cylinder with a small piston which holds the hammer against the work. This arrangement requires but little labor on the part of the operator and has increased the number of staybolts driven to a considerable extent. When staybolts are driven by hand 500 ends, or 400 inside and 600 outside, were considered a fair day's work with two boilermakers and a helper, whose wages would amount to $11.85 per day. With the improved tools it is possible to drive 1,000 ends per day with two boilermakers, resulting in a saving of $13.75 on 1,000 ends. Two fireboxes thus driven will nearly pay for the cost of the tool.

In driving mudring rivets, as shown in Fig. 2, one of these hammers is used as a holder-on which strikes a few blows just as the rivet is being upset against the sheet. The second hammer, which is held by a ball joint, has sufficient movement to enable the operator to drive the rivet, while the spring attachment holds the hammer against the rivet and all that is required of the operator is to hold the throttle open and give the hammer the necessary rotary movement. This also requires one less man and doubles the output. The third tool is a pneumatic cannon, shown in Fig. 3. This tool is used for various purposes both in boiler and machine work.

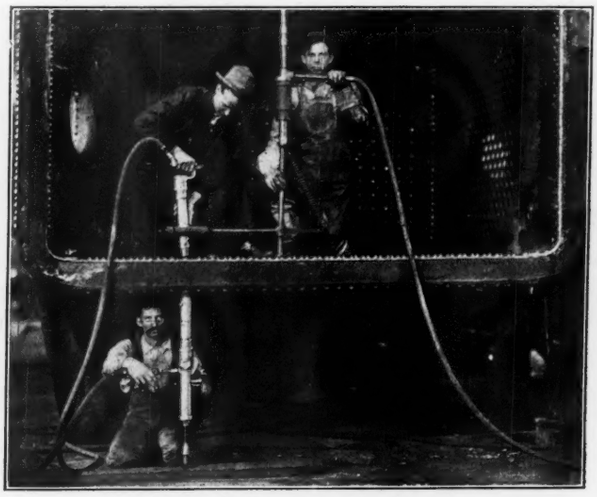


Fig. 2.

The telescoping feature of the hammer forces the punch against the job, while the second operation drives the bolt or punch through the sheet. They are used for knocking scale off the sheets and driving crown bolts out of boilers which are to receive new fireboxes. With this device the crown bar bolts are knocked out of an ordinary consolidation engine tool in seven hours. The tool shown in Fig. 4 is made like the barrel of a jack containing a spring of sufficient tension to little more than hold up the weight of the

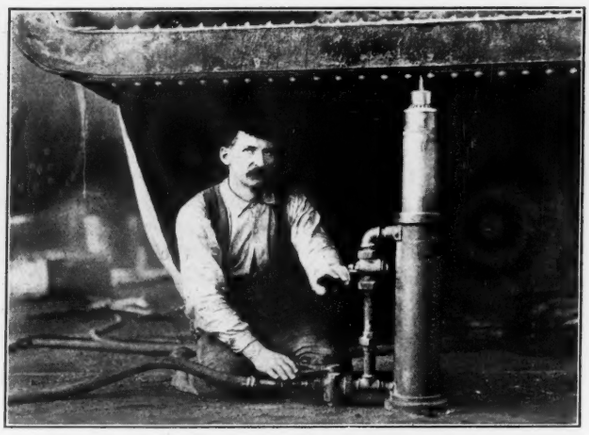


Fig. 3.

pneumatic drill. This is used in tapping and reaming overhead work, especially in the oil burning fireboxes where a taper screwed crown bolt having 1½ in. taper to the foot is used, which is tapped through the sheet.

The tool illustrated in Fig. 5 is used for holding the hammer up and pushing the expander into the flue. This relieves the operator from heavy work and to start the work he has only to open the hammer throttle. In general mudring rivets are driven out with the cannon, staybolts are broken with the pneumatic ram and clipped off with the ordinary clipper and

the burrs are knocked out with a punch inserted in the yoke riveter. These various tools have taken much of the hard work formerly done by hand away from the boilermakers and they have increased the output and improved the quality of the work.

The old method of driving staybolts by hand is crude and objectionable. The fiber of the iron is split and spread over

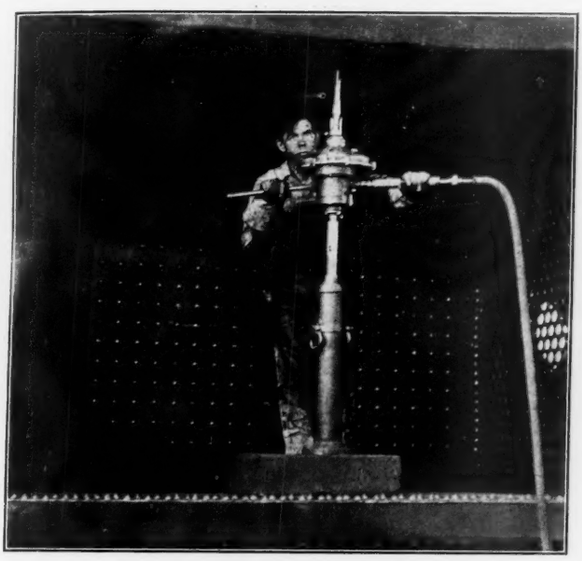


Fig. 4.

the surface of the sheet, to a large extent leaving thin edges which curl up and burn off, especially on oil-burning locomotives, while with the new method the fiber of the iron is held together while being driven down and the edges are formed like the head of a rivet and give better satisfaction in service. There is also in use in this shop a portable,

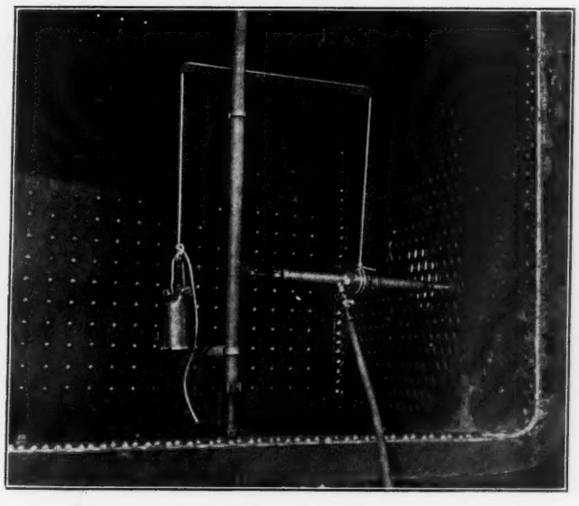


Fig. 5.

self-supporting crane holding the yoke riveter and moved by the overhead traveling crane. This is a four-ton crane mounted on a piece of boiler steel 10 ft. in diameter and 1¾ in. thick. It is used for holding the yoke riveter, staybolt clipper and staybolt breaker and other tools.

The yoke riveter is used for driving burrs out of wrapper sheet after staybolts have been broken and firebox removed. Patents for the above articles have been applied for. We are indebted to D. P. Kellogg, Master Mechanic of the Southern Pacific at Los Angeles, for these notes and the illustrations.

BLACKWELL'S ISLAND BRIDGE.

[WITH AN INSET.]

REPORT OF BOLLER & HODGE.

In accordance with the resolutions of the Board of Estimate and Apportionment, dated June 5, Boller & Hodge, Consulting Engineers, New York, submitted on October 28, to James W. Stevenson, Commissioner of Bridges, the following report (which we have abridged) on the carrying capacity of the Blackwells Island Bridge over the East river:

The Blackwells Island Bridge extends from Sixtieth street and Second avenue, Borough of Manhattan, to Jackson avenue and Jane street, Borough of Queens, a distance of about 8,600 ft., made up of steel viaduct approaches at each end with a cantilever structure over the two channels and over Blackwells Island, having a length of 3,724½ ft. between anchorages. This cantilever structure differs from the usual type in having the lower ends of each shore lever arm attached by a rocker arm to the upper ends of each island lever arm, thus making the entire structure continuous. In accordance with our instructions we have confined our investigation to the cantilever structure, and all of our findings apply only to that portion of the bridge between the anchor piers.

This cantilever was originally designed to carry a 35½-ft. driveway, two 11-ft. sidewalks, four lines of trolley cars and two lines of elevated railway.

The contract was let to the Pennsylvania Steel Co. on November 20, 1903, and this contract design . . . will hereafter be referred to as the original design. It was estimated that the weight of the original design would be 84,300,000 lbs., made up as follows:

Nickel steel eye-bars	12,200,000 lbs.
Nickel steel pins	1,100,000 lbs.
Structural steel eye-bars	400,000 lbs.
Structural steel pins	50,000 lbs.
Structural steel, other than eye-bars and pins	69,550,000 lbs
Steel castings	1,000,000 lbs.
	84,300,000 lbs.

But the final sections and details had not been made when this estimate of weight was given, so the full data for an accurate estimate of weight did not then exist.

In September, 1904, it was decided to add two more lines of elevated railway to the original design. But it was determined that the four elevated tracks would not be immediately needed, so the bridge is now built with the outside footwalk stringers and the overhanging ends of the upper floor beams omitted, with the sidewalks placed (for the present) in the place of the two outside elevated tracks.

The original specifications called for a "congested" live load of 12,600 lbs. p. l. f. bridge, made up as follows:

2 elevated railway tracks at 1,700 lbs. p. l. f.	= 3,400 lbs. p. l. f.
4 trolley railway tracks at 1,000 lbs. p. l. f.	= 4,000 lbs. p. l. f.
35½-in. roadway at 100 lbs. per sq. ft.	= 3,550 lbs. p. l. f.
2 11-in. sidewalks at 75 lbs. per sq. ft.	= 1,650 lbs. p. l. f.
	12,600 lbs. p. l. f.

and a "regular" live load of one-half the amount, or 6,300 lbs. p. l. f.

But when adding the two additional lines of elevated railway these loads were increased by the weight of these two additional tracks, giving a "congested" live load of 16,000 lbs. p. l. f. bridge, and a "regular" load of 8,000 lbs., p. l. f. bridge.

These uniform loads were specified for the main truss members only, and the floor systems and secondary truss members were to be designed for the following live loads:

On each elevated railroad track [26,000 lbs. on each of four axles spaced 6 ft., 10 ft. and 6 ft. apart, respectively].

On each street car track [26,000 lbs. on each of two axles spaced 10 ft. apart] or 1,800 lbs. per lin. ft. of track.

On any part of the roadway 48,000 lbs. on two axles, 10 ft. apart and 5 ft. gage covering a space 12 x 30 ft., and 100 lbs. per sq. ft. on the remaining roadway surface.

On the footwalk a load of 100 lbs. per sq. ft.

The dead weight was specified . . . without any allowance for snow. The wind load was 2,000 lbs. p. l. f. bridge, of

which 1,000 lbs. was assumed to be a moving load and 1,000 lbs. a fixed load.

The specifications state that some of the eye bars and pins will be of nickel steel of the following chemical requirements:

	Per Cent., Max.
Phosphorus (basic)	.04
Phosphorus (acid)	.06
Sulphur	.05
	Per Cent., Min.
Nickel	3.25

The annealed specimens of this material were required to have the following physical values:

Elastic limit	48,000 lbs. minimum per sq. in.
Ultimate strength	85,000 lbs. minimum per sq. in.
Elongation in 8 in.	1,600,000—ultimate

The full-sized annealed bars of this material (up to a maximum size of 16 in. by 2½ in.) were required to show the following results:

Elastic limit	48,000 lbs. minimum per sq. in.
Ultimate strength	85,000 lbs. minimum per sq. in.
Elongation in 18 ft.	9 per cent.

All other material in the structure was to be of open hearth steel, specimens (except rivets and steel castings) to show the following chemical results:

	Per Cent., Max.
Phosphorus (basic)	.04
Phosphorus (acid)	.08
Sulphur	.05

And to have the following physical values:

Elastic limit, plates and shapes	30,000 lbs. per sq. in. minimum
Elastic limit, eye bars	½ of ultimate
Ultimate strength, plates and shapes	60,000 lbs. desired
Ultimate strength, eye bars	66,000 lbs. desired
Elongation, per cent. in 8 in.	1,500,000—ultimate strength

And annealed full-size eye bars to show results as follows:

Elastic limit	28,000 lbs. per sq. in. minimum
Ultimate strength	56,000 lbs. per sq. in. minimum
Elongation in body of bar	10 per cent.

We have examined the detailed reports of the mill inspectors on this material, and find that they show the metal fulfilled the above specifications.

With the above loads and quality of material, the following unit stresses were specified:

	For Dead Load and Regular Live Load or for Dead Load and Wind	For Dead Load and Congested Live Load
For Nickel Steel in Eye Bars and Pins—	Pounds Per Sq. In.	
Tension	30,000	39,000
Shear on pins	20,000	24,000
Bearing on diameter of pins	40,000	48,000
Bending on outer fiber of pins	40,000	48,000
For structural Steel in Main Members of Trusses, Towers and Bracing—		
Tension	20,000	24,000
Compression	20,000-90 1/r*	24,000-100 1/r*
Shear on shop rivets, bolts and pins	13,000	16,000
Bearing on diameter of shop rivets, bolts and pins	25,000	30,000
Bending on outer fiber of pins	25,000	30,000
For Structural Steel in Secondary Members of Trusses—	Pounds Per Sq. In.	
Tension in sub-verticals (hangers)	18,000	
Compression in sub-diagonals	18,000-80 1/r*	
Shear on shop rivets, and bolts	12,000	
Bearing on diameter of shop rivets and bolts	24,000	
For Structural Steel in Floor System of Roadway and Footways and in all Floor Beams—		
Tension chords	15,000	
Shear on shop rivets, bolts and web-plates, net section	10,000	
Bearing on shop rivets and bolts	20,000	
For Structural Steel in Floor System (Including Brackets) for Railroad and Trolley Tracks—		
Tension chords	10,000	
Shear on shop rivets, bolts and web-plates, net section	7,000	
Bearing on shop rivets and bolts	14,000	
Allowable Pressure on Masonry—		
For dead load and regular live load	550	
For dead load and congested live load	650	

*Where 1 = length, and r = radius of gyration, both in inches.

These specifications and original contract drawings form the basis of our investigation, and in addition we used the detailed shipping invoices showing exact weights, and detailed shop drawings showing the areas of the sections. We also computed, from contract drawings, the weight of the flooring material [etc.]. We also figured the amount of steel which will be required at some future time to complete the two sidewalks in their final position, and all of these weights were found to be as follows:

	lbs. p. l. f. bridge.	lbs. p. l. f. bridge.
2 outside footwalk stringers	176	
Overhanging footwalk brackets	100	Add'l steel 403
Footwalk gratings	127	
2 upper outside railings	142	
2 upper inside railings	90	232
Reinforced concrete slabs for footwalk		500
Rails and contact rails for four upper tracks		330
Guard timbers and ties for four upper tracks		640
2 lower railings		174
Rails and conductor rails, 4 lower tracks		375
Wood paving blocks of roadway		1,041
Concrete under roadway paving blocks		3,200
Pipes, mail chutes, telephone, telegraph and feeder wires		405
		7,300

This total load is referred to as "additional material," being all the dead load except the shipped weight of structural steel.

From the above data we have computed the live and dead stresses and unit stresses. [See inset.] . . . .

The actual shipping weight of steel now in the structure, as at present finished, is 105,152,010 lbs., made up as follows:

Nickel steel eye bars	9,179,133 lbs.	
Nickel steel pins	1,460,563 lbs.	
Nickel steel links and pin plates	1,010,034 lbs.	
Nickel steel castings	119,900 lbs.	
Total nickel steel		11,769,630 lbs.
Structural steel eye bars	5,654,400 lbs.	
Structural steel pins	38,566 lbs.	
Structural steel other than eye bars and pins	84,795,779 lbs.	
Steel castings	2,253,094 lbs.	
Small iron castings	47,786 lbs.	
Cast-iron curb	592,755 lbs.	
Total structural steel		93,382,380 lbs.
Total weight		105,152,010 lbs.
This weight is distributed as follows:		
Towers		12,633,200 lbs.
Anchorages		995,500 lbs.
Trusses, Bracing and Floor		91,493,310 lbs.
Total		105,152,010 lbs.

The dead load stresses have been figured on the assumption that both rocker arms will be adjusted so that no dead load will pass through them. . . .

In accordance with the terms of the specifications, we have assumed the live load to be "placed so as to give the greatest strain in each part of the structure." . . . For the secondary members, except in a few cases where the bottom chord is not straight between adjacent main panel points, the live load stresses were figured with the local loads specified.

[Because of the rocker member construction, live load stresses could not be computed by the static method, and were therefore found by means of the elastic properties of the materials.] . . .

In computing deflections we used the gross area of all riveted tension members. . . . We used a modulus of elasticity of 28,000,000 lbs. for both carbon and nickel steel.

We computed the wind stresses on the assumption that all wind pressure is transmitted by the transverse bracing directly to the lower chord, the upper horizontal bracing being for vibration only. We computed the stresses for a fixed load of 1,000 lbs. p. l. f. over the entire structure and, for an additional live load of 1,000 lbs. p. l. f. placed so as to give the greatest stress in each member. . . . We only show the chord stresses on our stress sheet, as the web stresses cannot be given with accuracy, since there is a solid buckle plate floor which carries a large portion of the wind shear. [Erection stresses were also computed.]

The specifications do not call for any snow load, so that we have not figured any stresses for such a load, but in our opinion, a bridge of this character, with a practically solid lower floor 87 ft. wide and an upper deck with two sidewalks and four lines of railroad track, should have been calculated for a considerable snow load.

We made a stress sheet for the loads called for in the speci-

fications, but it was evident that the structure could not safely carry these loads, so we had to find the maximum safe carrying capacity of the structure. The final stresses under the conditions of safety hereinafter recommended are shown on our general stress sheet. [See inset.] There are two areas given for the main posts; the first is the area at point of maximum width, and these posts decrease in area toward their ends, as the side plates keep the same thickness but decrease in width, giving the second area at the bottom. Ths first areas for the other vertical posts are exclusive of the area of the transverse diaphragms at these posts, and the others are inclusive of these diaphragms. . . . The unit stresses here shown are the direct stresses from dead and live loads without any additions for reverse stresses, snow, wind, impact, or secondary stresses.

[The stresses in many of the floor beams and stringers were computed and results reported.] In a few of the lower floor beams and trolley stringers, the unit stresses exceed those specified; and this excess has been caused by their having been computed for a dead load less than the actual weight as finally called for by the flooring contracts, but this excess is so slight that, in our opinion, it will not affect their safety.

. . . . The maximum erection stresses in the chords do not equal the completed dead load stresses, and only in a few diagonals near the main piers do they equal the specified live and dead load stresses; so they furnish no data in the way of a full-size test to determine the carrying capacity of the members, as the structure under traffic will be subjected to greater stresses than it was during erection. . . .

We find that the secondary stresses due to temperature are generally small, except in the post U75-L75, where, in our opinion, the maximum stress from this source will occur, as this is the free end of the island span, and a variation of ± 60 deg. F. will move the top of this post and bend it around its fixed lower end, producing a fiber stress of 3,200 lbs. per sq. in. The secondary stresses, due to distortion of the true figure of the trusses by the live load, are quite considerable, as the vertical deflection of the point L37 is $18^{5}/_{10}$ in., and of the point L91, $14^{2}/_{10}$ in. for a live load of 3,000 lbs. p. l. f. truss.

We have made a careful analytical computation of the horizontal movement of the point U17 (and other similar points over the main piers) caused by this distortion, and for a live load of 3,000 lbs. p. l. f. truss in the position giving the maximum direct stress in the post U17-L17 we find this movement causes a fiber stress in the lower fixed end of U17-L17 of 2,600 lbs. per sq. in., which is the maximum stress from this source, which occurs simultaneously with a maximum direct stress. The fiber stresses in the other similar posts are about the same, except that for U75-L75 it is reduced to 1,400 lbs. per sq. in. owing to the fact that this is the free end of the island span; but this should be added to the temperature fiber stress in this post as above given. This distortion also causes some horizontal movement of the top ends of the rocker arms relative to their bottom ends, and this relative movement causes additional secondary stresses, but the stresses found from this cause were so small as to be safely negligible. The fiber stresses due to bending of members from their own weight depends to some extent on the total live load and dead load direct stresses on the members, but for a live load of 3,000 lbs. p. l. f. truss we find this fiber stress to be about 1,200 lbs. per sq. in. for many of the members, with extreme values running as high as 3,500 lbs. per sq. in.

There are also secondary stresses due to impact, and to bending in the vertical posts and hangers, caused by accelerating or retarding the moving loads on the upper floor, but we have not computed any values for these, as we are of the opinion that they are negligible in this structure where the relative value of live load as compared with the dead load is so small. The above maximum values of all these secondary stresses will probably not occur in the same members at the same time, but it will be seen that they may cause considerable increases in the direct unit stresses heretofore shown.

We have had a large number of the actual bridge members measured and calipered in the field, and we find that they agree with the shop drawings. We also computed the weight of a number of members from the shop drawings and find such weights agree with the shipping weights. We figured the net sections of the riveted tension members from the shop detail drawings. We have not carefully examined all details, but we have checked the end connections of such members as are most heavily stressed and find them equal in strength to those members.

We have carefully considered the form and details of the lower chord as this feature has been criticized in the public journals, and the impression has been given that the lower chords in this structure are weaker than those of the Quebec bridge, which, in our opinion, is not the case. There is no full-size experimental data for the carrying capacity of such large compression members as are used in this structure, though the recent tests on models of compression members for the Quebec bridge showed that such members when properly latticed carried 32,000 lbs. per sq. in. before failure, with a ratio of length to radius of gyration of 25. The only safety is to keep within the limits gained from experience on a smaller scale, as the means do not exist for learning the absolute carrying capacity of such sections, and a practical method of testing could not be provided in any reasonable time. In our opinion, however, it is safe to follow the established practice for compression values, provided the limits set are not too high and the details are sufficient to make the member act as a unit and not fail in detail.

The heavier sections of the lower chord of this bridge are built up of four vertical webs, each 48 in. deep and varying in thickness with the sections required. Each web has an 8-in. by 6-in. angle, top and bottom, forming a "built-up channel." Each outside pair of these "built-up" channels is latticed together, top and bottom, with 5-in. by ⅝-in. lacing bars, having two rivets in each end and one rivet at each intersection, the length of these lattice bars being about 45 in., c. to c. of end rivets. This gives two separate built-up channel chords 48 in. deep and 25 in. b. to b. of angles. These two separate sections are then connected together with top and bottom tie plates 15 in. long and ½ in. thick, spaced about 5 ft., c. to c. The entire chord is thus about 70 in.wide, b. to b. of outside angles. While this chord is not as stiff transversely as it would be if properly latticed from outside rib to outside rib, and while in our opinion the lattice on the center line, where the longitudinal shear due to bending is at its maximum, should not have been omitted, yet we believe that the chord is as strong horizontally as vertically, for the following reasons:

The radius of gyration of the chord about its horizontal axis averages 14 in. and the radius of gyration of each outside latticed pair of channels around a vertical axis averages 12 in., without any allowance for the connecting of these two pairs by the tie plates, which certainly add appreciably to the transverse stiffness, though the exact amount cannot be computed. However, the radius of gyration of the whole chord as a unit around a vertical axis is about 27, and while it would not be safe or proper to use this radius (owing to the omission of the central latticing), we consider it safe to assume that the tie plates add sufficient stiffness to increase the effective radius of gyration about a vertical axis from 12 to 14, and thus equal the vertical stiffness, which, of course, sets the limit of stiffness for the section.

We have used for this chord a radius of gyration of 14, and all our results are based on this radius, and we are of the opinion that the details are sufficient to cause it to act as a unit with this radius. The stress sheet shows that there are other compression members in the web system of the trusses which have higher unit stresses than the lower chord, with a greater value of L/R, so the safety of the bridge is not alone determined by the value of this chord.

We find in the bridge no evidence of loose rivets or buckling of members, or other indications of overloading.

Conclusions.

First—That the specifications are clear and explicit and cover all the necessary requirements for the material and workmanship of a first-class structure, but in our opinion the working stresses given are in excess of good practice.

Second—That the steel manufactured for this structure is first-class bridge material and in accordance with the specifications.

Third—That the workmanship of this structure is first-class and in accordance with the requirements of the specifications.

Fourth—That the erection and field riveting of the structure appears to have been done in a first-class manner.

Fifth—That the actual sections of the various members agree with the sections ordered on the working drawings and shown on our sheets Nos. 8 and 9, and that the shipping weights are correct.

Sixth—That the members of floor systems are safe for the specified local live loads.

Seventh—That the following unit stresses in the main truss members, viz.:

	Lbs. Per Square Inch.
Tension nickel steel bars	30,000
Tension structural steel bars and riveted members	20,000
Compression structural steel up to L/R = 20	19,000
Compression structural steel for L/R above 20	20,000-50 L/R

are the limit of safety for the direct stresses from the sum of the live and dead loads, as the secondary and snow load stresses heretofore referred to will add to these unit stresses and thereby increase the actual unit stresses.

Eighth—That the main truss members will not carry all the specified live loads for which this structure was designed.

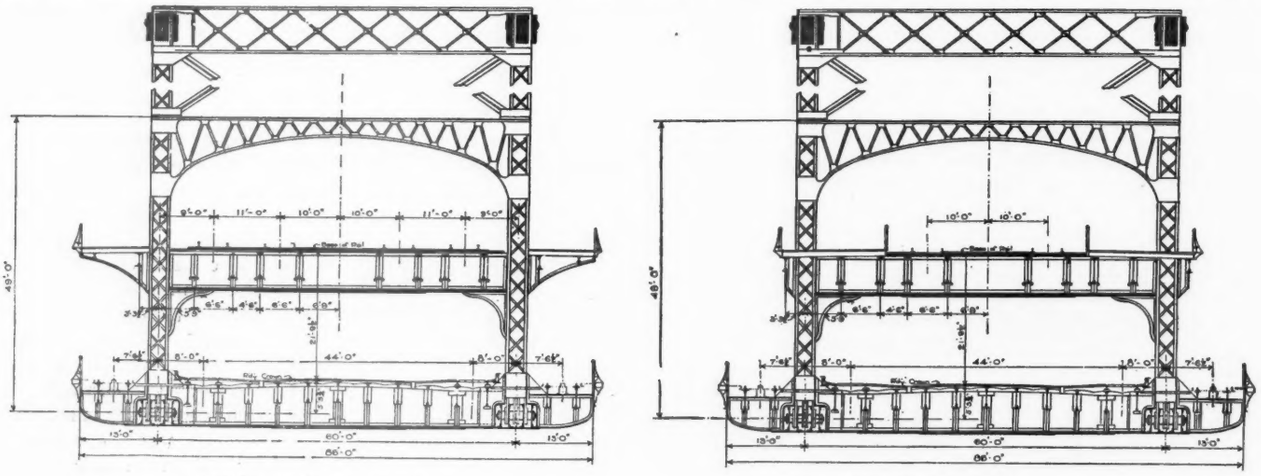
Ninth—That the structure can safely carry a considerable live load in addition to its actual dead load.

As we, therefore, do not think the structure can carry all the specified live loads and yet is safe for considerable live load, we have tried to arrive at the actual live load which may safely come on this structure, using actual moving loads now in use on the subway, elevated, and surface lines of the city.

The heaviest trolley car now actually in use in this city . . . . gives an average load of 1,460 lbs. p. l. f. of each trolley track. . . . The average weight of an elevated or subway train made up of five motor cars and three trailer cars is 1,810 lbs. p. l. f. track.

The specified live load for the main trusses is 100 lbs. per sq. ft. on the roadways, and 75 lbs. per sq. ft. on the footwalks, and while we believe such loads are proper for designing local members of the floor system and secondary truss members, they are undoubtedly excessive for the main truss members, as no such load can possibly come on the entire width of the roadway and sidewalks for any considerable length of the structure. For the main truss members, we, therefore, consider a live load of 50 lbs. per sq. ft. on the roadway and sidewalks to be fully sufficient.

By trial, we find that the main trusses will safely carry a live load of 3,000 lbs. p. l. f. of each truss, if the dead load be reduced by 1,000 lbs. per lineal foot of each truss. Some of this dead load, consisting of the outer sidewalk stringers, floor-beam brackets, sidewalk gratings, and track material for the railway tracks on the upper deck has never been put on the structure, and some of the dead load now on can be omitted, thus decreasing the full dead load and permitting the use of the above live load. Furthermore, the average live load on the trolley tracks can be reduced by regulating the minimum spaces between same, as these units are so small that for the main trusses the load is practically uniform for the cars spaced at reasonable intervals. For the elevated railroad tracks it is not possible to greatly reduce the effective load per lineal foot by regulating the intervals between trains, as these trains are long and heavy units, and if trains are spaced at intervals of three or more train lengths, they will fall in such positions as to practically produce the maximum stresses in important parts of the structure. With these live loads, the roadway and footwalks produce a live load of 17¾ ft. + 11 ft. = 28¾ ft. @ 50 lbs. = 1,437 lbs. per lineal foot of truss, and if we assume each trolley track to be loaded with cars at clear intervals of one car length, or about 85 ft. c. to c., they will produce a live load of 2 × 730 lbs. = 1,460 lbs. per lineal foot of truss, making a total live load of 2,897 lbs. per lineal foot of truss, which would require a reduction in the dead load of about 1,000 lbs. per lineal foot of truss to meet the conditions of safety, and this reduction can be readily made.



Modified design for future. *As built at present.*

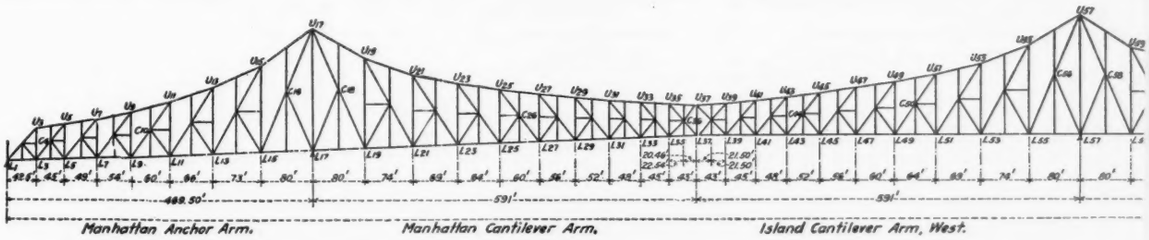
Cross Sections; Blackwell's Island Bridge.

We, therefore, come to the conclusion that it is safe to run the four lines of trolley cars on this bridge as at present constructed, if the portions of the dead load not yet in place, and not required for highway or trolley service, be omitted, and if the four lines of inside track stringers on the upper deck be removed.

The "additional" dead load then will consist of the following items:

	Lbs. p. l. f. bridge.
Concrete sub-pavement of roadway	3,200
Wood block sub-pavement of roadway	1,040
Rails and conductor rails for 4 trolley tracks	374
Concrete footwalk slabs	800
6 railings	406
Electric wires, gas mains, etc	160
	5,980
Less deduction for removing 4 lines of stringers	680
	5,300

or 2,650 lbs. p. l. f. each truss, which is a reduction of 1,000



The following figures show stresses in main trusses, according to contract specifications and according to the gre permissible loading recommended by Boller & Hodge. The stresses in only the island cantilever arm west and the is span are given here. The highest unit stresses of each kind of member throughout the bridge are as follows:

	RECOMMENDED LOADING.				CONTRACT SPECIFICATION LOADING.			
Bottom chord:								
Compression....	16,800 lbs.	L65-L67;	area,	686.7 sq. in. gr.	26,800 lbs.	L65-L67;	area,	686.7 sq.
Tension.....	8,600 "	L35-L37;	"	{ 105.0 / { 86.4
Top chord:								
Compression....	6,900 "	U37-U39;	"	43.0 " gr.	19,900 "	U37-U39;	"	{ 43.0 / { 34.4
Tension.....	30,600 "	U65-U69;*	"	360.0 " nt.	49,000 "	U65-U69;*	"	360.0
Main diagonals:								
Compression....	10,500 "	L73-C74;	"	388.7 " gr.	23,300 "	L91-C92;	"	{ 46.0
Tension.....	19,300 "	C116-L117†	"	114.7 " nt.	33,300 "			{ 37.2
Main posts:								
Compression....	17,400 "	U17-L17;‡	"	1,211.8 " gr.	25,800 "	U117-L117;§	"	110.7
Tension.....	19,800 "	U59-L59;§	"	236.9 " nt.	35,200 "	U59-L59;§	"	236.9
Rocker arms:								
Compression....	8,300 "	U37-L37;	"	{ 44.1 " gr.	22,500 "	U37-L37;	"	{ 44.1
Tension.....	10,900 "			{ 31.2 " nt.	28,600 "			{ 31.2
Hangers:								
Tension.....	15,200 "	C92-L92;	"	31.0 " nt.	22,900 "	C92-L92;	"	31.0
Sub-diagonals:								
Compression....	11,300 "	C8-L9;	"	31.1 " gr.	15,500 "	L121-C122;	"	23.0
Tension.....	10,100 "	U89-C90;	"	36.0 " nt.	14,700 "	U89-C90;	"	36.0
Sub-posts:								
Compression....	7,700 "	U14-C14;	"	15.0 " gr.	7,700 "	U14-C14;	"	15.0

* Nickel-steel eyebars. † Carbon-steel eyebars. ‡ For maximum area of member. §For minimum area of member.

RECOMMENDED LOADING.

Island Cantilever Arm, West.

Bottom Chord.

Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.*	L/R abt.	Wind stress.
L37-L39	75.0 Gr.	— 15	00	00	— 15	— 0.2	18	± 54
L39-L41	105.0 Gr.	— 621	608	505	— 1229	—11.7	19	± 187
L41-L43	210.0 Gr.	— 1476	917	589	— 2393	—11.4	21	± 363
L43-L45	247.6 Gr.	— 2672	1245	603	— 3917	—15.8	22	± 593
L45-L47	355.6 Gr.	— 4227	1623	579	— 5850	—16.4	24	± 888
L47-L49	510.8 Gr.	— 6049	2026	528	— 8075	—15.8	26	± 1269
L49-L51	666.8 Gr.	— 8009	2429	466	—10438	—15.7	27	± 1903
L51-L53	834.8 Gr.	—10015	2816	410	—12831	—15.4	30	± 2727
L53-L55	949.2 Gr.	—11332	3004	351	—14336	—15.1	32	± 3776
L55-L56	1040.2 Gr.	—11668	2947	290	—14615	—14.0	34	± 4741
L56-L57	1072.1 Gr.	—11668	2947	290	—14615	—13.6	34	± 5861

* In units of 1,000 lbs. per sq. in. Compression indicated by —; tension, +.

Top Chord.

U37-U39	43.0 Gr.			334		— 299	— 6.9	29
	34.4 Nt.	+	35		294	+ 329	+ 9.6	
U39-U41	43.0 Gr.			294		— 121	— 2.8	30
	34.4 Nt.	+	173		297	+ 470	+13.7	
U41-U43	106.0 Gr.			477				40
	88.0 Nt.	+	714		608	+ 1322	+15.0	
U43-U45	94.5 Nt.	+	1585	560	918	+ 2503	+26.5	Nickel steel eyebars.
U45-U47	141.8 Nt.	+	2810	577	1255	+ 4065	+28.7	
U47-U49	210.0 Nt.	+	4406	552	1641	+ 6407	+28.8	
U49-U51	290.0 Nt.	+	6302	504	2062	+ 8364	+28.8	
U51-U53	384.0 Nt.	+	8385	445	2494	+10879	+28.3	
U53-U55	496.0 Nt.	+10890		417	3024	+13914	+28.1	
U55-U57	612.0 Nt.	+13409		399	3528	+16937	+27.7	

Main Diagonals.

U37-C38	57.2 Gr.	—	50	416		— 466	— 8.1	44
	45.7 Nt.				509	+ 459	+10.0	
C38-L39	74.6 Gr.	—	222	420		— 642	— 8.6	46
	61.0 Nt.				416	+ 194	+ 3.2	
L39-C40	92.5 Gr.			373				56
	77.4 Nt.	+	704		530	+ 1234	+15.9	
C40-U41	84.3 Nt.	+	842	336	536	+ 1378	+16.3	Structural steel eyebars.
L41-C42	105.0 Nt.	+	1217	271	586	+ 1803	+17.2	
C42-U43	115.5 Nt.	+	1370	242	599	+ 1969	+17.0	
L43-C44	136.5 Nt.	+	1760	191	649	+ 2409	+17.6	
C44-U45	152.2 Nt.	+	1945	173	681	+ 2626	+17.3	
L45-C46	173.3 Nt.	+	2342	138	741	+ 3083	+17.8	
C46-U47	189.0 Nt.	+	2554	125	782	+ 3336	+17.6	
L47-C48	210.0 Nt.	+	2842	86	795	+ 3637	+17.3	
C48-U49	224.0 Nt.	+	3084	79	844	+ 3928	+17.5	
L49-C50	228.0 Nt.	+	3205	43	804	+ 4009	+17.6	
C50-U51	248.0 Nt.	+	3482	39	859	+ 4341	+17.5	
L51-C52	240.0 Nt.	+	3454	10	776	+ 4230	+17.6	
C52-U53	280.0 Nt.	+	3772	9	837	+ 4609	+16.5	
L53-C54	182.0 Nt.	+	2414	236	689	+ 3103	+17.0	
C54-U55	204.0 Nt.	+	2763	236	752	+ 3515	+17.2	
L55-C56	106.1 Gr.			698		— 270	— 2.5	93
	89.9 Nt.	+	428		629	+ 1057	+11.8	
C56-U57	129.7 Gr.			698				93
	108.2 Nt.	+	824		695	+ 1519	+14.0	

CONTRACT SPECIFICATION LOADING.

Island Cantilever Arm, West.

Bottom Chord.

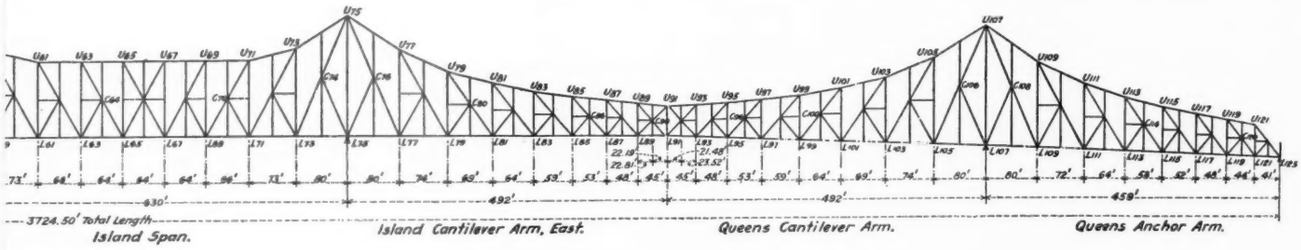
Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.	L/R abt.
L37-L39	75.0 Gr.	— 15	....	....	— 15	— 0.2	18
L39-L41	105.0 Gr.	— 680	1621	1347	— 2301	—21.9	19
					+ 667		
L41-L43	210.0 Gr.	— 1620	2446	1570	— 4066	—19.4	21
L43-L45	247.6 Gr.	— 2929	3321	1609	— 6250	—25.2	22
L45-L47	355.6 Gr.	— 4625	4327	1545	— 8952	—25.2	24
L47-L49	510.8 Gr.	— 6604	5404	1409	—12008	—23.5	26
L49-L51	666.8 Gr.	— 8722	6478	1243	—15200	—22.8	27
L51-L53	834.8 Gr.	—10876	7509	1094	—18385	—22.0	30
L53-L55	949.2 Gr.	—12271	8011	935	—20282	—21.4	32
L55-L56	1040.2 Gr.	—12601	7858	773	—20459	—19.7	34
L56-L57	1072.1 Gr.	—12601	7858	773	—20459	—19.1	34

Top Chord.

U37-U39	43.0 Gr.			890		— 855	—19.9	29
	34.4 Nt.	+	35		785	+ 820	+23.8	
U39-U41	43.0 Gr.			785		— 598	—13.9	30
	34.4 Nt.	+	187		793	+ 980	+28.5	
U41-U43	106.0 Gr.			1271		— 489	— 4.6	40
	88.0 Nt.	+	782		1621	+ 2403	+27.3	
U43-U45	94.5 Nt.	+	1739	1492	2447	+ 4186	+44.3	Nickel steel eyebars.
U45-U47	141.8 Nt.	+	3079	1538	3346	+ 6425	+45.3	
U47-U49	210.0 Nt.	+	4819	1473	4375	+ 9194	+43.8	
U49-U51	290.0 Nt.	+	6878	1343	5498	+12376	+42.7	
U51-U53	384.0 Nt.	+	9128	1186	6651	+15779	+41.1	
U53-U55	496.0 Nt.	+11822		1112	8065	+19887	+40.1	
U55-U57	612.0 Nt.	+14516		1065	9409	+23925	+39.1	

Main Diagonals.

U37-C38	57.2 Gr.	—	50	1109		— 1159	—20.3	44
	45.7 Nt.				1358	+ 1308	+28.6	
C38-L39	74.6 Gr.	—	242	1119		— 1361	—18.2	46
	61.0 Nt.				1109	+ 867	+14.2	
L39-C40	92.5 Gr.			995		— 221	— 2.4	56
	77.4 Nt.	+	774		1412	+ 2186	+28.2	
C40-U41	84.3 Nt.	+	926	895	1428	+ 2354	+27.9	Structural steel eyebars.
L41-C42	105.0 Nt.	+	1338	724	1562	+ 2900	+27.6	
C42-U43	115.5 Nt.	+	1505	644	1597	+ 3102	+26.9	
L43-C44	136.5 Nt.	+	1926	509	1730	+ 3656	+26.8	
C44-U45	152.2 Nt.	+	2128	462	1815	+ 3943	+25.9	
L45-C46	173.3 Nt.	+	2555	368	1977	+ 4532	+26.2	
C46-U47	189.0 Nt.	+	2785	334	2085	+ 4870	+25.8	
L47-C48	210.0 Nt.	+	3087	230	2121	+ 5208	+24.8	
C48-U49	224.0 Nt.	+	3348	210	2250	+ 5598	+25.0	
L49-C50	228.0 Nt.	+	3464	114	2143	+ 5607	+24.6	
C50-U51	248.0 Nt.	+	3761	105	2290	+ 6051	+24.4	
L51-C52	240.0 Nt.	+	3711	27	2069	+ 5780	+24.1	
C52-U53	280.0 Nt.	+	4049	25	2231	+ 6280	+22.4	
L53-C54	182.0 Nt.	+	2556	630	1837	+ 4393	+24.1	
C54-U55	204.0 Nt.	+	2926	630	2006	+ 4932	+24.2	
L55-C56	106.1 Gr.			1861		— 1476	—13.9	93
	89.9 Nt.	+	385		1678	+ 2063	+22.9	
C56-U57	129.7 Gr.			1861		— 1058	— 8.2	93
	108.2 Nt.	+	803		1852	+ 2655	+24.5	



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Recommended Loading.

Main Posts.

Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.	L/R abt.	Wind stress.
U39-L39	44.1 Gr.†	— 175	48	00	— 223	— 5.1	38	
	72.9 Gr.‡	— 219	60	00	— 279	— 3.8		
U41-L41	74.7 Gr.	— 616	370	233	— 986	—13.2	41	
	102.7 Gr.	— 664	379	229	— 1043	—10.2		
U43-L43	103.0 Gr.	— 1004	418	169	— 1422	—13.8	42	
	139.8 Gr.	— 1064	429	166	— 1493	—10.7		
U45-L45	130.4 Gr.	— 1419	477	121	— 1896	—14.5	46	
	166.2 Gr.	— 1486	490	119	— 1976	—11.9		
U47-L47	156.2 Gr.	— 1783	517	77	— 2300	—14.7	48	
	191.5 Gr.	— 1862	532	76	— 2394	—12.5		
U49-L49	178.6 Gr.	— 2106	527	38	— 2633	—14.7	54	
	213.5 Gr.	— 2153	544	37	— 2697	—12.6		
U51-L51	186.4 Gr.	— 2304	509	9	— 2813	—15.1	51	
	221.7 Gr.	— 2356	527	9	— 2883	—13.0		
U53-L53	136.2 Gr.	— 1423	447	208	— 1870	—13.7	59	
	172.2 Gr.	— 1479	467	208	— 1946	—11.3		
U55-L55	88.5 Gr.	+ 393	407		— 14	— 0.2	63	
	76.5 Nt.	+ 446		641	+ 1087	+14.2		
	126.0 Gr.	+ 335	428		— 93	— 0.7		
		+ 393		641	+ 1034			

† Minimum. ‡ Maximum.

Rocker Arm and Hangers.

U37-L37	44.1 Gr.		376		— 366	— 8.3	64
	31.2 Nt.	+ 10		331	+ 341	+10.9	
C38-L38	31.0 Nt.	+ 237	00	191	+ 428	+13.8	
C40-L40	31.0 Nt.	+ 166	10	159	+ 325	+10.5	
C42-L42	31.0 Nt.	+ 173	15	167	+ 340	+11.0	
C44-L44	31.0 Nt.	+ 217	00	166	+ 383	+12.4	
C46-L46	44.0 Nt.	+ 244	00	175	+ 419	+ 9.5	
C48-L48	44.0 Nt.	+ 277	00	184	+ 461	+10.5	
C50-L50	44.0 Nt.	+ 315	00	192	+ 507	+11.5	
C52-L52	44.0 Nt.	+ 359	00	203	+ 562	+12.8	
C54-L54	52.0 Nt.	+ 400	00	213	+ 613	+11.8	
C56-L56	52.0 Nt.	+ 448	00	223	+ 671	+12.9	

Sub Diagonals.

C38-L37	21.5 Nt.	+ 24	00	00	+ 24	+ 1.1	
C38-U39	36.0 Nt.	+ 219	....	135	+ 354	+ 9.8	
C40-L41	23.0 Gr.	— 134	103	7	— 237	—10.3	39
C42-L43	25.7 Gr.	— 152	107	10	— 259	—10.1	43
C44-L45	28.4 Gr.	— 185	106	....	— 291	—10.2	48
C46-L47	31.1 Gr.	— 213	111	....	— 324	—10.4	41
C48-L49	33.8 Gr.	— 243	114	....	— 357	—10.6	45
C50-L51	36.4 Gr.	— 278	117	....	— 395	—10.9	50
C52-L53	42.1 Gr.	— 318	120	....	— 438	—10.4	48
C54-L55	49.4 Gr.	— 349	121	....	— 470	— 9.5	58
C56-L57	75.0 Gr.	— 397	122	....	— 519	— 6.9	90

Sub Posts.

U38-C38	15.0 Gr.	— 17	....	....	— 17	— 1.1	
U40-C40	15.0 Gr.	— 19	....	....	— 19	— 1.3	
U42-C42	15.0 Gr.	— 32	....	....	— 32	— 2.1	
U44-C44	15.0 Gr.	— 31	....	....	— 31	— 2.1	
U46-C46	15.0 Gr.	— 39	....	....	— 39	— 2.6	
U48-C48	15.0 Gr.	— 44	....	....	— 44	— 2.9	
U50-C50	15.0 Gr.	— 59	....	....	— 59	— 3.9	
U52-C52	15.0 Gr.	— 76	....	....	— 76	— 5.1	
U54-C54	15.0 Gr.	— 104	....	....	— 104	— 6.9	57
U56-C56	21.8 Gr.	— 137	....	....	— 137	— 6.3	61

Island Span.

Bottom Chord.

L57-L58	1066.9 Gr.	—11634	2963	307	—14597	—13.7	34	±5861
L58-L59	1049.9 Gr.	—11634	2963	307	—14597	—13.9	34	±5262
L59-L61	1032.8 Gr.	—12204	3471	452	—15675	—15.2	31	±4909
L61-L63	925.5 Gr.	—11043	3839	893	—14882	—16.1	28	±4551
L63-L65	770.0 Gr.	— 9135	3721	1093	—12856	—16.7	27	±4289
L65-L67	686.7 Gr.	— 7958	3606	1209	—11564	—16.8	27	±4100
L67-L69	651.3 Gr.	— 7346	3376	1129	—10722	—16.4	27	±3979
L69-L71	685.5 Gr.	— 7893	3257	952	—11153	—16.3	28	±3926
L71-L73	717.0 Gr.	— 8042	2733	528	—10775	—15.0	31	±3947
L73-L74	711.2 Gr.	— 7398	2196	335	— 9594	—13.5	34	±4028
L74-L75	711.2 Gr.	— 7398	2196	335	— 9594	—13.5	34	±4258

Contract Specification Loading.

Main Posts.

Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.	L/R abt.	Wind stress.
U39-L39	44.1 Gr.	— 191	127	....	— 318	— 7.2	38	
	72.9 Gr.	— 257	220	....	— 477	— 6.5		
U41-L41	74.7 Gr.	— 674	988	620	— 1662	—22.3	41	
	102.7 Gr.	— 745	1057	591	— 1802	—17.5		
U43-L43	103.0 Gr.	— 1098	1115	450	— 2213	—21.5	42	
	139.8 Gr.	— 1183	1199	428	— 2382	—17.0		
U45-L45	130.4 Gr.	— 1547	1271	322	— 2818	—21.6	46	
	166.2 Gr.	— 1641	1369	306	— 3010	—18.1		
U47-L47	156.2 Gr.	— 1937	1379	204	— 3316	—21.2	48	
	191.5 Gr.	— 2045	1492	194	— 3537	—18.5		
U49-L49	178.6 Gr.	— 2273	1406	101	— 3679	—20.6	54	
	213.5 Gr.	— 2351	1533	97	— 3884	—18.2		
U51-L51	186.4 Gr.	— 2472	1356	24	— 3828	—20.5	51	
	221.7 Gr.	— 2557	1496	23	— 4053	—18.3		
U53-L53	136.2 Gr.	— 1495	1193	555	— 2688	—19.7	59	
	172.2 Gr.	— 1586	1344	555	— 2930	—17.0		
U55-L55	88.5 Gr.	+ 489	1084		— 595	— 6.7	63	
	76.5 Nt.	+ 542		1708	+ 2250	+29.4		
	126.0 Gr.	+ 392	1247		— 855	— 6.8		
		+ 489		1708	+ 2197			

Rocker Arm and Hangers.

U37-L37	44.1 Gr.		1003		— 993	—22.5	64
	31.2 Nt.	+ 10		884	+ 894	+28.6	
C38-L38	31.0 Nt.	+ 269	....	379	+ 648	+20.9	
C40-L40	31.0 Nt.	+ 187	28	313	+ 500	+16.1	
C42-L42	31.0 Nt.	+ 195	40	330	+ 525	+16.9	
C44-L44	31.0 Nt.	+ 243	....	320	+ 563	+18.2	
C46-L46	44.0 Nt.	+ 272	....	338	+ 610	+13.9	
C48-L48	44.0 Nt.	+ 307	....	355	+ 662	+15.0	
C50-L50	44.0 Nt.	+ 347	....	371	+ 718	+16.3	
C52-L52	44.0 Nt.	+ 393	....	391	+ 784	+17.8	
C54-L54	52.0 Nt.	+ 437	....	411	+ 848	+16.3	
C56-L56	52.0 Nt.	+ 488	....	434	+ 922	+17.7	

Sub Diagonals.

C38-L37	21.5 Nt.	+ 24	....	....	+ 24	+ 1.1	
C38-U39	36.0 Nt.	+ 241	....	268	+ 509	+14.1	
C40-L41	23.0 Gr.	— 148	203	19	— 351	—15.3	39
C42-L43	25.7 Gr.	— 166	212	26	— 378	—14.7	43
C44-L45	28.4 Gr.	— 202	205	....	— 407	—14.3	48
C46-L47	31.1 Gr.	— 231	214	....	— 445	—14.3	41
C48-L49	33.8 Gr.	— 262	221	....	— 483	—14.3	45
C50-L51	36.4 Gr.	— 297	225	....	— 522	—14.3	50
C52-L53	42.1 Gr.	— 338	231	....	— 569	—13.5	48
C54-L55	49.4 Gr.	— 370	233	....	— 603	—12.2	58
C56-L57	75.0 Gr.	— 419	237	....	— 656	— 8.7	90

Sub Posts.

U38-C38	15.0 Gr.	— 17	....	....	— 17	— 1.1	
U40-C40	15.0 Gr.	— 19	....	....	— 19	— 1.3	
U42-C42	15.0 Gr.	— 32	....	....	— 32	— 2.1	
U44-C44	15.0 Gr.	— 31	....	....	— 31	— 2.1	
U46-C46	15.0 Gr.	— 39	....	....	— 39	— 2.6	
U48-C48	15.0 Gr.	— 44	....	....	— 44	— 2.9	
U50-C50	15.0 Gr.	— 59	....	....	— 59	— 3.9	
U52-C52	15.0 Gr.	— 76	....	....	— 76	— 5.1	
U54-C54	15.0 Gr.	— 104	....	....	— 104	— 6.9	57
U56-C56	21.8 Gr.	— 137	....	....	— 137	— 6.3	61

Island Span.

Bottom Chord.

L57-L58	1066.9 Gr.	—12566	7902	820	—20468	—19.2	34	±5861
L58-L59	1049.9 Gr.	—12566	7902	820	—20468	—19.5	34	±5262
L59-L61	1032.8 Gr.	—13271	9255	1206	—22526	—21.8	31	±4909
L61-L63	925.5 Gr.	—12090	10238	2381	—22328	—24.1	28	±4551
L63-L65	770.0 Gr.	—10063	9922	2916	—19985	—26.0	27	±4289
L65-L67	686.7 Gr.	— 8805	9615	3225	—18420	—26.8	27	±4100
L67-L69	651.3 Gr.	— 8136	9002	3011	—17138	—26.3	27	±3979
L69-L71	685.5 Gr.	— 8710	8685	2539	—17395	—25.4	28	±3926
L71-L73	717.0 Gr.	— 8813	7287	1407	—16100	—22.5	31	±3947
L73-L74	711.2 Gr.	— 8041	5855	894	—13896	—19.5	34	±4028
L74-L75	711.2 Gr.	— 8041	5855	894	—13896	—19.5	34	±4258

IDER CONTRACT SPECIFICATION LOADING AND UNDER GREATEST LOADING RECOMMENDED BY BOLLER & HODG

Recommended Loading.

Top Chord.

Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.	L/R abt.	Wind stress.
U57-U59	660.0 Nt.	+14597	498	4093	+18690	+28.3	Nickel steel eyebars.	
U59-U61	516.0 Nt.	+11509	888	3942	+15451	+29.9		
U61-U63	426.0 Nt.	+ 9281	1093	3721	+13002	+30.5		
U63-U65	384.0 Nt.	+ 8094	1209	3606	+11700	+30.5		
U65-U69	360.0 Nt.	+ 7508	1221	3491	+10999	+30.6		
U69-U71	360.0 Nt.	+ 7478	1129	3376	+10854	+30.2		
U71-U73	392.0 Nt.	+ 8249	949	3343	+11592	+29.6		
U73-U75	448.0 Nt.	+ 9662	587	3222	+12884	+28.8		

Main Diagonals.

U57-C58	365.0 Gr.	— 1395	2131	1210	— 3526	— 9.7	94	
C58-L59	400.0 Gr.	— 1872	2131	1145	— 4003	—10.0	94	
U59-C60	225.3 Nt.	+ 2460	899	1055	+ 3515	+15.6		
C60-L61	238.7 Gr.		902				38	
	199.5 Nt.	+ 2092		996	+ 3088	+15.5		
U61-C62	330.7 Nt.	+ 3950	854	1565	+ 5515	+16.7		
C62-L63	304.5 Nt.	+ 3607	884	1539	+ 5146	+16.9		
U63-C64	239.7 Nt.	+ 2496	914	1398	+ 3894	+16.2		
C64-L65	261.9 Gr.		921				45	
	218.6 Nt.	+ 2194		1384	+ 3578	+16.4		
U65-C66	196.9 Gr.		1002				40	
	163.7 Nt.	+ 1228		1267	+ 2495	+15.2	40	
C66-L67	181.9 Gr.		1054		— 110	— 0.6	40	
	151.2 Nt.	+ 944		1265	+ 2209	+14.6		
L67-C68	211.9 Gr.	— 340	1215		— 1555	— 7.3	45	
	171.6 Nt.			1113	+ 773	+ 4.5		
C68-U69	177.5 Gr.	— 65	1172		— 1237	— 7.0	40	
	148.0 Nt.			1124	+ 1059	+ 7.2		
L69-C70	196.9 Gr.		1141		— 285	— 1.4	35	
	164.2 Nt.	+ 856		1260	+ 2116	+12.9		
C70-U71	217.6 Gr.		1109				35	
	181.3 Nt.	+ 1146		1284	+ 2430	+13.4		
L71-C72	211.0 Gr.		1216		— 1205	— 5.7	38	
	176.4 Nt.	+ 11		948	+ 959	+ 5.4		
C72-U73	187.5 Gr.		1212		— 875	— 4.7	38	
	157.0 Nt.	+ 337		1006	+ 1343	+ 8.5		
L73-C74	388.7 Gr.	— 2004	2091	1149	— 4095	—10.5	94	
C74-U75	353.0 Gr.	— 1598	2091	1214	— 3689	—10.4	94	

Main Posts.

U57-L57	1250.6 Gr.	—15022	3459	779	—18481	—14.7	54
	1096.8 Gr.	—15582	3459	779	—19041	—17.4	54
U59-L59	236.9 Nt.	+ 2731	881	1956	+ 4687	+19.8	
		+ 2642	902	1956	+ 4598		
U61-L61	163.3 Gr.	— 1092	726		— 1818	—11.1	54
		— 1023		798			
	227.3 Gr.	— 1144	744		— 1888	— 8.3	
		— 1092		797			
U63-L63	281.0 Gr.	— 2445	1229	803	— 3674	—13.1	62
	343.0 Gr.	— 2494	1241	797	— 3735	—10.9	
U65-L65	191.0 Gr.	— 1283	1114		— 2397	—12.5	57
		— 1209		880			
	254.5 Gr.	— 1331	1124		— 1455	— 5.7	
		— 1283		872			
U67-L67	100.8 Gr.	— 144	00	00	— 144	— 1.4	54
	165.8 Gr.	— 192	35	00	— 227	— 1.4	
U69-L69	141.8 Gr.	— 128	988		— 1116	— 7.9	54
	121.7 Nt.	— 63		1030	+ 967	+ 7.9	
	206.3 Gr.	— 176	1000		— 1176	— 5.7	
		— 128		1024	+ 896		
U71-L71	174.2 Gr.	+ 657	685		— 28	— 0.2	57
	148.7 Nt.	+ 730		1075	+ 1805	+12.1	
	237.7 Gr.	+ 605	703		— 98	— 0.4	
		+ 657		1074	+ 1731		
U73-L73	236.9 Nt.	+ 2769	885	1919	+ 4688	+19.8	
		+ 2680	906	1919	+ 4599		
U75-L75	919.3 Gr.	—10041	2957	1028	—12998	—14.2	54
	816.8 Gr.	—10480	2957	1028	—13437	—16.5	54

Hangers.

C58-L58	51.0 Nt.	+ 493	....	223	+ 716	+14.0	
C60-L60	51.0 Nt.	+ 401	....	211	+ 612	+12.0	
C62-L62	43.0 Nt.	+ 349	....	197	+ 546	+12.7	
C64-L64	43.0 Nt.	+ 324	....	192	+ 516	+12.0	
C66-L66	43.0 Nt.	+ 314	....	192	+ 506	+11.8	
C68-L68	43.0 Nt.	+ 310	....	192	+ 502	+11.7	
C70-L70	43.0 Nt.	+ 323	....	197	+ 520	+12.1	
C72-L72	51.0 Nt.	+ 362	....	211	+ 573	+11.2	
C74-L74	51.0 Nt.	+ 411	....	223	+ 634	+12.4	

Sub Diagonals.

C58-L57	75.0 Gr.	— 477	122	....	— 599	— 8.0	90	
C60-L59	53.0 Gr.	— 368	120	....	— 488	— 9.2	30	
C62-L61	45.7 Gr.	— 343	113	....	— 456	—10.0	31	
C64-L63	42.1 Gr.	— 302	109	....	— 411	— 9.8	31	
C66-L65	53.0 Gr.	— 285	109	....	— 394	— 7.4	37	
C68-L69	42.1 Gr.	— 275	109	....	— 384	— 9.1	31	
C70-L71	45.7 Gr.	— 290	113	....	— 403	— 8.8	31	
C72-L73	53.0 Gr.	— 324	120	....	— 444	— 8.4	30	
C74-L75	75.0 Gr.	— 406	122	....	— 528	— 7.0	90	

Sub Posts.

U58-C58	21.8 Gr.	— 151	....	....	— 151	— 6.9	60	
U60-C60	15.0 Gr.	— 107	....	....	— 107	— 7.1	62	
U62-C62	15.0 Gr.	— 84	....	....	— 84	— 5.6		
U64-C64	15.0 Gr.	— 75	....	....	— 75	— 5.0		
U66-C66	15.0 Gr.	— 71	....	....	— 71	— 4.7		
U68-C68	15.0 Gr.	— 71	....	....	— 71	— 4.7		
U70-C70	15.0 Gr.	— 73	....	....	— 73	— 4.9		
U72-C72	15.0 Gr.	— 88	....	....	— 88	— 5.9	62	
U74-C74	21.8 Gr.	— 107	....	....	— 107	— 4.9	60	

Contract Specification Loading.

Top Chord.

Member.	Area in sq. in.	Dead load.	Live load.—	Live load.+	D.L. +L.L.	Unit stress.	L/R abt.	Wind stress.
U57-U59	660.0 Nt.	+15866	1329	10913	+26779	+40.6	Nickel steel eyebars.	
U59-U61	516.0 Nt.	+12593	2368	10511	+23104	+44.8		
U61-U63	426.0 Nt.	+10218	2916	9922	+20140	+47.3		
U63-U65	384.0 Nt.	+ 8950	3225	9615	+18565	+48.4		
U65-U69	360.0 Nt.	+ 8318	3256	9309	+17627	+49.0		
U69-U71	360.0 Nt.	+ 8276	3011	9002	+17278	+48.0		
U71-U73	392.0 Nt.	+ 9094	2531	8916	+18010	+45.9		
U73-U75	448.0 Nt.	+10583	1566	8592	+19175	+42.8		

Main Diagonals.

U57-C58	365.0 Gr.	— 1736	5684		— 7420	—20.3	94	
				3227	+ 1491			
C58-L59	400.0 Gr.	— 2234	5684		— 7918	—19.8	94	
				3053	+ 819			
U59-C60	225.3 Nt.	+ 2503	2397	2813	+ 5316	+23.6		
C60-L61	238.7 Gr.		2405		— 291	— 1.2	38	
	199.5 Nt.	+ 2114		2655	+ 4769	+23.9		
U61-C62	330.7 Nt.	+ 4195	2276	4173	+ 8368	+25.3		
C62-L63	304.5 Nt.	+ 3833	2358	4103	+ 7936	+26.1		
U63-C64	239.7 Nt.	+ 2665	2437	3729	+ 6394	+26.7		
C64-L65	261.9 Gr.		2456		— 111	— 0.4	45	
	218.6 Nt.	+ 2345		3692	+ 6037	+27.6		
U65-C66	196.9 Gr.		2671		— 1346	— 6.8	40	
	163.7 Nt.	+ 1325		3380	+ 4705	+28.7		
C66-L67	181.9 Gr.		2811		— 1789	— 9.8	40	
	151.2 Nt.	+ 1022		3374	+ 4396	+29.1		
L67-C68	211.9 Gr.	— 382	3241		— 3623	—17.1	45	
	171.6 Nt.			2969	+ 2587	+15.1		
C68-U69	177.5 Gr.	— 89	3124		— 3213	—18.1	40	
	148.0 Nt.			2998	+ 2909	+19.7		
L69-C70	196.9 Gr.		3044		— 2157	—11.0	35	
	164.2 Nt.	+ 887		3360	+ 4247	+25.9		
C70-U71	217.6 Gr.		2957		— 1761	— 8.1	35	
	181.3 Nt.	+ 1196		3425	+ 4621	+25.5		
L71-C72	211.0 Gr.	— 98	3243		— 3341	—15.8	38	
	176.4 Nt.			2529	+ 2431	+13.8		
C72-U73	187.5 Gr.		3232		— 2984	—15.9	38	
	157.0 Nt.	+ 248		2684	+ 2932	+18.7		
L73-C74	388.7 Gr.	— 2350	5577		— 7927	—20.4	94	
				3064	+ 714			
C74-U75	353.0 Gr.	— 1922	5577		— 7499	—21.2	94	
				3238	+ 1316			

Main Posts.

U57-L57	1250.6 Gr.	—15937	9222	2077	—25159	—20.1	54
	1096.8 Gr.	—16497	9222	2077	—25719	—23.4	54
U59-L59	236.9 Nt.	+ 3120	2349	5217	+ 8337	+35.2	
		+ 2993	2511	5217	+ 8210		
U61-L61	163.3 Gr.	— 1060	1937		— 2997	—18.4	54
		— 991		2127	+ 1136		
	227.3 Gr.	— 1147	2078		— 3225	—14.2	
		+ 1060		2121	+ 1061		
U63-L63	281.0 Gr.	— 2594	3277	2142	— 5871	—20.9	62
	343.0 Gr.	— 2675	3370	2098	— 6045	—17.6	
U65-L65	191.0 Gr.	— 1368	2971		— 4339	—22.7	57
		— 1294		2347	+ 1053		
	254.5 Gr.	— 1448	3048		— 4496	—17.7	
		— 1368		2289	+ 921		
U67-L67	100.8 Gr.	— 144	....	....	— 144	— 1.4	54
	165.8 Gr.	— 224	191	....	— 415	— 2.5	
U69-L69	141.8 Gr.	— 107	2635		— 2742	—19.3	54
	121.7 Nt.	— 42		2746	+ 2704	+22.2	
	206.3 Gr.	— 188	2725		— 2913	—14.1	
		— 107		2699	+ 2592		
U71-L71	174.2 Gr.	+ 804	1827		— 1023	— 5.9	57
	148.7 Nt.	+ 877		2866	+ 3743	+25.2	
	237.7 Gr.	+ 717	1967		— 1250	— 5.3	
		+ 804		2859	+ 3663		
U73-L73	236.9 Nt.	+ 3143	2360	5118	+ 8261	+34.9	
		+ 3016	2522	5118	+ 8134		
U75-L75	919.3 Gr.	—10686	7886	2741	—18572	—20.2	54
	816.8 Gr.	—11125	7886	2741	—19011	—23.3	54

Hangers.

C58-L58	51.0 Nt.	+ 533	....	434	+ 967	+19.0	
C60-L60	51.0 Nt.	+ 437	....	406	+ 843	+16.5	
C62-U62	43.0 Nt.	+ 382	....	380	+ 762	+17.7	
C64-L64	43.0 Nt.	+ 356	....	371	+ 727	+16.9	
C66-L66	43.0 Nt.	+ 346	....	371	+ 717	+16.7	
C68-L68	43.0 Nt.	+ 342	....	371	+ 713	+16.6	
C70 L70	43.0 Nt.	+ 356	....	380	+ 736	+17.1	
C72-L72	51.0 Nt.	+ 398	....	406	+ 804	+15.8	
C74-L74	51.0 Nt.	+ 451	....	434	+ 885	+17.4	

Sub Diagonals.

C58-L57	75.0 Gr.	— 499	237	....	— 736	— 9.8	90	
C60-L59	53.0 Gr.	— 389	231	....	— 620	—11.7	30	
C62-L61	45.7 Gr.	— 362	218	....	— 580	—12.7	31	
C64-L63	42.1 Gr.	— 320	211	....	— 531	—12.6	31	
C66-L65	53.0 Gr.	— 303	211	....	— 514	— 9.7	37	
C68-L69	42.1 Gr.	— 293	211	....	— 504	—12.0	31	
C70-L71	45.7 Gr.	— 309	218	....	— 527	—11.5	31	
C72-L73	53.0 Gr.	— 345	231	....	— 576	—10.9	30	
C74-L75	75.0 Gr.	— 428	237	....	— 665	— 8.9	90	

Sub Posts.

U58-C58	21.8 Gr.	— 151	....	....	— 151	— 6.9	60	
U60-C60	15.0 Gr.	— 107	....	....	— 107	— 7.1	62	
U62-C62	15.0 Gr.	— 84	....	....	— 84	— 5.6		
U64-C64	15.0 Gr.	— 75	....	....	— 75	— 5.0		
U66-C66	15.0 Gr.	— 71	....	....	— 71	— 4.7		
U68-C68	15.0 Gr.	— 71	....	....	— 71	— 4.7		
U70-C70	15.0 Gr.	— 73	....	....	— 73	— 4.9		
U72-C72	15.0 Gr.	— 88	....	....	— 88	— 5.9	62	
U74-C74	21.8 Gr.	— 107	....	....	— 107	— 4.9	60	

Wind stress.

±5861
±5262
±4909
±4551
±4289
±4100
±3979
±3926
±3947
±4028
±4258

& HODGE; BLACKWELL'S ISLAND BRIDGE.

lbs. p. l. f. each truss from the full assumed dead load.

The concrete footwalk slabs are here taken at 800 lbs. p. l. f., whereas they were taken at 500 lbs. p. l. f. in the full dead load; this is due to the fact that in the completed structure they are intended to be 10½ ft. wide, whereas those now temporarily placed on the outer lines of railway stringers are 16 ft. wide. To reach the full reduction required, it will also be noted that we have reduced the allowance for wires and pipes to 160 lbs. p. l. f. bridge.

With a live load of 50 lbs. per sq. ft. on the roadway and footwalks, and a live load of 780 lbs. per lineal foot of each trolley track (which is equivalent to running trolley cars at intervals of 80 ft. c. to c.), we get a total live load of 3,000 lbs. per lineal foot of each truss, and with this live load in addition to the total assumed dead load reduced by 1,000 lbs. per lineal foot of truss, we have made the complete stress sheet herewith submitted [see inset], and it will be seen that all these stresses come practically within the limits of safety set by us, and the bridge is, in our opinion, safe for these loads. . . .

The dead load of the floor systems can be further reduced if necessary, and we are of the opinion that by reducing the dead loads on all the lever arms, and perhaps increasing the dead loads on the island span and anchor arms, the structure can be made to safely carry one pair of elevated tracks.

In our opinion the most practical method of getting this bridge into prompt service is to remove the stringers from the two inside lines of upper railway tracks, and open the bridge for service of the highway, sidewalks and four trolley tracks immediately.

If at some future time it is found necessary to make use of one pair of elevated tracks, further modifications of the dead loads can be made and the outer lines of elevated railway stringers used for their true purpose; the sidewalks being removed to their final position outside the trusses.

We therefore make the following

Recommendations:

First—That the stringers of the two inside tracks on the upper decks, or other equivalent dead load, be removed to lighten the dead load.

Second—That the trolley traffic be so regulated that if four tracks are in use the cars shall not run with clear intervals between them of less than their own length.

Third—That the bridge be opened for the traffic of the sidewalks, highway and four lines of trolley tracks as at present constructed, subject to the above recommendations.

Fourth—That if any other moving loads be added to the structure, such further modifications of the dead load shall first be made as will keep the total direct stresses caused by the live and dead loads within the safe limits herein set.

Under these recommendations we are confident the structure is perfectly safe.

REPORT OF PROF. BURR.

[The first part of the report submitted by W. H. Burr, Consulting Engineer, is omitted, as it deals with the general feaures of the bridge, steel specifications, etc., which are given in the Boller & Hodge report.]

Proper provision for various classes of loading for a structure of such magnitude, designed to carry an extraordinary volume of traffic, with the corresponding working stresses, is largely a matter of judgment. This broad question was given much consideration by a Commission of Bridge Experts, appointed to examine and pass upon the plans for the Manhattan Bridge, under date of March 9, 1903. The Manhattan Bridge was planned for the same total traffic capacity as that of the Blackwell's Island bridge, and that commission recommended the same "congested" and "regular" loads of 16,000 lbs. and 8,000 lbs. per lin. ft. of bridge as prescribed for the Blackwell's Island Bridge. That commission, consisting of George S. Morison, C. C. Schneider, Mansfield Merriman, Henry W. Hodge and Theodore Cooper, stated, however, that the "congested" load "is a possible load which could never occur unless special pains were taken to produce it." With such an improbable but possible load, the working stresses may properly be taken substantially higher than for a "regular" load, which, while not likely to exist frequently, is far more likely to occur than the "congested." This commission made no recommendation as to working stresses for the "congested" load, but stated "that the bridge should be so proportioned that with the 'congested' load of 16,000 lbs. per lin. ft., covering the whole bridge, combined with dead load and wind pressure, no stresses would be produced anywhere reaching the elastic limit of the material. * * * In other words, it should not be possible for such an extraordinary 'congested' load to do any permanent injury to the bridge."

Inasmuch as actual tests of full size annealed eye-bars of both ordinary structural and nickel steel have shown that the elastic limits of those members may be safely taken at about 28,000 lbs. per sq. in. and 48,000 lbs. per sq. in., respectively, it will be found that the prescribed working stresses under the congested live load in the specifications of the Blackwell's Island Bridge lie within the prescribed limits set forth by the commission named above. In fact, it appears from the latest tests of full size carbon structural steel and nickel steel columns that the greatest prescribed working stresses for the compression members of the Blackwell's Island Bridge lie sensibly below those limits. It appears from a careful reading of the report of this commission in connection with the specifications for the Blackwell's Island Bridge that the latter was modelled closely upon the lines laid down in the report of the commission so far as they were applicable to the Blackwell's Island structure.

While therefore the specified loads and working stresses for the Blackwell's Island Bridge are to be considered as safe and satisfactory in the light of knowledge and precedent available when they were drawn, it is my judgment that the experience which has accrued in connection with the actual construction of long span bridge structures within the intervening five years is such as to require some modification of the high working stresses then thought permissible. I cannot concur in the opinion of the above commission that a possible combination of loads should be permitted to produce stresses just under the elastic limit. Whatever may have been considered permissible then, it is my judgment that the loading should be so modified now as to produce maximum stresses sensibly lower than that limit. It would be prudent to limit the greatest possible stresses produced by the "congested," dead and wind loads to three-fourths of the elastic limit.

In view of the increasing concentrated loads of nearly all kinds of traffic passing over such a structure as the Blackwell's Island Bridge, it is my judgment that the working tensile stress in subverticals or hangers could judiciously be limited to 15,000 lbs. per sq. in. instead of 18,000 lbs. per sq. in., although the use of the latter value does not prejudice the safety or durability of the structure. Such members, however, are subject to shock and greater concentrated loads than may be contemplated and a wide margin of safety is advisable for stresses so produced.

[The report then takes up the quality of work done by the steel company; dead weight of bridge as built; floor system; and erection stresses, all of which is similar to the Boller & Hodge report.]

If the usual street cleaning removal of snow from the bridge is promptly made, it is clear that there is practically no possibility or snow load and even the regular live load concurring. The administrtion of this structure should, therefore, be stringently carried out to meet that requirement, otherwise an objectionable overloading is possible.

* * * I have had computed a complete stress sheet for the greatest possible stresses in every part or member of the entire structure using the prescribed "congested" moving load

and wind loading and the actual dead weight of the structure. * * * The results show that there are a considerable number of the main truss members which would be overstressed under the provisions of the specifications for the assumed loading. Some of the bottom chord panels of the Island span would carry about 25 per cent. more than permitted by the specifications for compression under dead and congested live loads. The bottom chords of some other portions of the bridge would be overstressed under the same conditions up to a maximum of about 15 per cent. With the same conditions of loading as above, the nickel steel eye-bars in the top chords of the Island span would be overstressed about 25 per cent. as a maximum, and 20 per cent. in the top chord of the Queens cantilever arm, while the maximum overstress in the Manhattan cantilever arm and the two Island cantilever arms would be 15 per cent. to 20 per cent. The overstresses in a number of the carbon steel eye-bars would range from 10 to 15 per cent. in some members in all parts of the structure except in the Queens anchor arm where 30 per cent. is reached in one case. There would be also some similar overstresses in riveted tension members in the same parts of the bridge rising above 33 per cent. in a single instance. Few main posts in all the bridge would be overstressed as much as 25 per cent. In the Queens anchor arm there is one post which would be overstressed 33 per cent. The Manhattan rocker arm would be overstressed nearly 20 per cent. in tension and 30 per cent. in compression, while the Queens rocker arm would be subjected to an excess of 10 per cent. in tension and 12 per cent. in compression. Among the secondary or sub-truss members, one hanger near the centre of the Manhattan cantilver span would be overstressed about 20 per cent. and another about 10 per cent. All other hangers, subdiagonals and sub-posts would receive practically their proper stresses only.

These greatest overstresses, running with two or three exceptions not above a maximum of 25 per cent of the stresses permitted under the specifications, would not be serious if the permitted working stresses were not initially high. There are bridges in use and considered safe in which similar overstresses exist, although such conditions can never be considered satisfactory. As none of these excessive stresses per square inch of cross-section, even when combined with wind load stresses, exceed some of the elastic limits determined by experiment for the corresponding members in which they are found, those stresses exceed but little, if any, the limits permitted for the stresses due to the congested live, dead and wind loads of the Commission of Bridge Experts whose report has already been alluded to. In my judgment, however, as already expressed, the maximum stresses permitted in that report, under the congested, dead and wind loads, are too high, and these computations show that sufficient provision was not made in designing the cross-sections of the members of the Blackwell's Island Bridge for the two additional elevated tracks which were added to the structure in 1904.

To ascertain the safe maximum loading it is considered prudent to adopt for the greatest permissable working stresses those prescribed in the specifications "For Dead Load and Regular Live Load or for Dead Load and Wind," except that, for reasons given later on, the working stress for columns will be taken as 20,000-50 1/r.

Substantial advantage may be gained by removing some portions of the dead load of the floors. By the removal of considerable concrete under the two inside trolley tracks of the lower deck, some other floor details and two upper elevated railway tracks, including the supporting stringers, and re-arrangement of sidewalk railings of the upper deck, the dead weight may be reduced at least 1,272 lbs. per lineal foot of each truss on all the contilever arms. It is conducive to relieving the maximum stresses to permit the weight of the lower deck to remain unchanged on the Island span and the two anchor arms. The relief of dead weight on those three parts of the bridge would then be but 380 lbs. per lineal foot of truss.

The conditions which will produce a congested load in one direction will be likely to stop traffic largely or entirely in the other direction, as has frequently been observed. For this reason, it is believed that 50 lbs. per sq. ft. of roadway and sidewalk is sufficient for an assumed congested load for the main truss members, that loading to cover any or all parts of the structure necessary to give any member its greatest possible stress.

[The report then gives weights of rolling stock and resulting loads p. l. f., similar to the Boller & Hodge report.]

All dense trolley or elevated railway traffic on the East river bridges must be effectively controlled by proper signals and continuous inspection, as experience has demonstrated on the Brooklyn and Williamsburg bridges. In computing the stresses in the main truss members of the Blackwell's Island Bridge the same control of the trolley traffic will be assumed as that exercised on the Brooklyn Bridge and on the Williamsburg Bridge, two succeeding trolley cars being separated by a clear space of about two car lengths. Similarly, the control of the traffic on the two elevated tracks would be secured by making the minimum distance between the heads of trains 1,000 ft. as is now done on the Brooklyn Bridge. The maximum stresses produced in the trusses of the Blackwell's Island Bridge, however, are found by placing one 8-car train with an average of 1,810 lbs. p. l. f. of track at the center of each of the Manhattan and Queensboro cantilever spans, making the heads of trains about 1,722 ft. apart. Any other arrangement of trains with a distance from center to center not less than 1,000 ft. will produce less stresses in the truss members than that just described.

This total moving load, representing the maximum permissible traffic, arranged with two elevated railway tracks and constituting what may be called a congested live load will be as follows:

2 elevated 8-car trains, at 1,810 lbs.	3,620 lbs. p. l. f.
4 trolley tracks, ⅛ by 4 by 1,460 lbs.	1,947 lbs. p. l. f.
35.5 ft. roadway, at 50 lbs. per sq. ft.	1,775 lbs. p. l. f.
22 ft. sidewalk, at 50 lbs. per sq. ft.	1,100 lbs. p. l. f.
	8,442 lbs. p. l. f.

This total load of 8,442 lbs. is for each linear foot of bridge covered simultaneously by the four classes of traffic, each truss carrying one-half of this total.

Comparing results of this loading with the specified permissible unit stresses for dead load and regular live load, excepting those for columns already alluded to, a stress sheet for this loading shows that no unit compressive stress in all the trusses exceeds the prescribed working limit. Nor is there but one instance where nickel steel eye-bars show stresses as much as 4 per cent., or, but three instances as much as 3½ per cent. above prescribed value. Similarly, but one carbon steel tension member shows 4½ per cent. overstress. These overstresses are too small to be of moment and they may be ignored.

Therefore, the Blackwell's Island Bridge has a safe and satisfactory capacity for carrying a volume of traffic under the conditions of control found advisable by experience on the Brooklyn and Williamsburg Bridges, sufficient for a considerable future period and perhaps for a long future period. No elevated traffic can pass the structure for some time to come as there are no connections for such traffic at the Queensboro end of the bridge. Whenever such traffic may be required, the two elevated tracks on the upper deck will serve that purpose. The question of further accommodation for lines of traffic on the upper deck may judiciously be left for later consideration when demanded by future requirements and when the character of traffic to be accommodated at that time shall become known. It is only necessary so to adjust the accommodations for such future developments as will keep the unit stresses in the main truss members within the limits

prescribed in the specifications for regular live and dead loads or for those loads combined with the wind loading.

The formula given in the specifications for the safe carrying capacity of columns or posts of carbon structural steel members is 20,000-90 1/r lbs. per sq. in. Recent tests of full size members of this class indicate clearly that this formula gives results lower than need be taken for this class of members, and hence, in computing the proper working stresses for the structural steel members of this bridge, the value 20,000-50 1/r has been used. The ultimate carrying capacity, which is practically the elastic limit, of such columns with a ratio of length over radius of gyration of 40 to 50 is not less than 31,000 to 32,000 lbs. per sq. in., nor less than 28,000 to 29,000 lbs. per sq. in. for a ratio of length over radius of gyration of 90.

I recommend that the Department of Bridges have made and tested to destruction not less than six pairs of structural steel compression members, each pair being duplicates, similar in cross-section to the typical compression members in the chords and web members of this bridge, the areas of cross-section of such columns to be the greatest capable of being tested in the testing machines of the largest capacity in this country, such test columns to have pin heads. Such tests could be made within a comparatively short time; and if the test columns are judiciously designed with a range of length over radius of gyration varying from 40 to 100, valuable and accurate information as to the safe carrying capacity of such members would be disclosed. It is not necessary, however desirable it might be, to test columns of the greatest area of cross-section in the trusses, which are far beyond the maximum capacity of any testing machine now available.

[The report takes up secondary stresses due to distortion of trusses under live load, bending of members under own weight, and starting and stopping of trains, but finds all these need not be considered as materially affecting the main questions under discussion. Then follows a description and discussion of the bottom chords, the conclusions reached being similar to those of Boller & Hodge.]

The deflections of the extremities of the cantilever arms under the moving load shown on stress sheet accompanying this report may be as great as 2 inches. In computing this deflection the gross section of riveted tension members has been used, and a modulus of elasticity for both carbon and nickel steel of 28,000,000 lbs. per square inch. This deflection would be less if the depth of trusses were greater. Substantial economy would have been attained if the trusses had been designed with a greater depth and with longer panels in the main truss system, at the same time gaining greater stiffness.

The lateral stiffness of a cantilever structure, especially of this magnitude, is of much importance and it is affected greatly by the horizontal width between trusses, which in the present instance is 60 ft. A comparison of the length of the Manhattan cantilever arm, 591 ft., with this 60 ft. width between trusses shows that the latter dimension has been judiciously chosen, giving to the structure a proper lateral stiffness, especially in connection with the buckle plate floor.

Conclusions.

First—The specifications for the chemical and physical requirements of both the nickel and carbon steels employed in the structure are satisfactory and in accord with the best practice of the present time.

Second—Both the shop and mill inspection were efficiently performed, resulting in securing excellent quality of material and the fabrication of truss members of good quality and accurate dimensions.

Third—The various members of the structure possess the full sections required by the unit stresses and the working plans, and the shipping weights correspond correctly to those sections as well as to the computed weights.

Fourth—The erection was successfully and satisfactorily performed, leaving the trusses in correct alignment and elevation.

Fifth—Computations in accordance with the specifications for the maximum floor loads show that the capacities of the floors for both the upper and lower decks are satisfactory.

Sixth—Computations for all the main truss members of the bridge show that the stresses produced by the prescribed congested live load, combined with the dead load or with the dead load and wind loading are higher than prescribed as permissible in the specifications, and higher than prudent to permit, although practically not in excess of the limits approved by the Commission of Expert Engineers in 1903.

Seventh—The stresses disclosed by the stress sheet submitted with this report show that a controlled traffic on the four trolley lines of the lower deck and on two elevated railways of the upper deck carrying the heaviest cars of their classes now in use in the City of New York together with a vehicular traffic on the roadway and two loaded sidewalks may be permitted without exceeding the specified unit stresses for the regular live load and dead load and without exceeding the safe limits of stresses for such a structure, provided the re-arrangement of the floor of the lower deck and the removal of the two elevated railway tracks on the upper deck together with the re-arrangement of the sidewalk details be made as indicated in this report so as to reduce the dead load by at least 1,172 lbs. p. l. f. of each truss of the cantilever arms and 380 lbs. p. l. f. of each truss of the Island span and anchor arms. This re-arrangement and reduction of dead load can now be made without material delay in the opening of the bridge for traffic. The capacity so afforded is satisfactory and sufficient for a considerable future period. Any further use of the upper deck for elevated railway or other purposes should be deferred until the development of traffic in the future may make it necessary, and until it shall be determined what character of traffic must then be accommodated, but that adjustment to the future traffic should not be such as to produce greater unit stresses than those approved in this report.

Eighth—The distance between trusses is suitable to this type of structure and such as to secure satisfactory lateral stability, especially in connection with the buckle plate floor.

THE ROADMASTERS' CONVENTION.

The twenty-sixth annual convention of the Roadmasters' and Maintenance of Way Association was held in the Blatz Hotel, Milwaukee, Wis., November 10, 11 and 12, President J. A. Kerwin (St. L., I. M. & S.) in the chair. The association was welcomed by Mayor Rose, of Milwaukee.

In his address President Kerwin said:

"There are many men who have the natural talent to succeed, but the practical education which forms the stepping stone between the present situation and that just beyond, is lacking. Many who have captured success have been trained in the track department, rising from water boy to general manager of a railroad. This country is on the verge of far-reaching developments in the railroad line and the demand for good men is usually greater than the supply. Many of us who began as poor fellows 20 years ago, and lacked training, are still at the bottom of the ladder to-day. It has been ever thus and always will be. Therefore, young roadmaster, I recommend that you continue along the road of future success, work being your portion; striving in the meantime for a first class education, as this will fit you for grasping the opportunity when it presents itself."

The secretary reported the addition of 28 new members during the year. The officers for the ensuing year are:

President, A. E. Hansen (C. & N.-W.); First Vice-President, James Sweeney (C. & E. I.); Second Vice-President, W. A. Brandt (C. & N.-W.); Secretary and Treasurer, Walter E. Emery (P. & P. U.), re-elected; Member Executive Committee,

W. H. Kofmehl (C., M. & St. P.). Washington, D. C., was chosen as the next place of meeting.

The first report discussed was "How to Guard Against Stock Claims, Fire Claims and Injuries to Track Employees." The essential parts of the report are given in the following:

Stock Claims.—To guard against stock claims is to guard against the encroachment of stock on the right-of-way. To effectually accomplish this, the entire line must be protected by good substantial fences, first-class cattle guards and gates. The first two should be of the kind that will turn stock, and the last should be of a type that does not require the united efforts of three or four men to open and close it. Then too, the foreman must be educated up to a full realization of the importance of keeping the gates closed, and a break in a fence however slight, must be given immediate attention.

One of the most fruitful sources of stock claims is the difficulty of having farmers and others close their gates when not in actual use. Most states have stringent laws covering such criminal negligence and in order that all concerned may be fully aware of the penalties which attach to its violation, a notice printed on strong linen cloth, fully setting forth the provisions of the law, should be posted on each gate. Also before a farm crossing is established, the party to be served by same should be required to execute a "crossing agreement," in which it is stipulated that he shall keep the gate in repair, closed at all times when not in actual use, and that in driving stock across the right-of-way he shall take every reasonable precaution to guard against accidents. However, when feasible, all farm and public crossings should be established at points where a subway or overhead bridge can be built, and the company is justified in taking on considerable extra expense to provide such crossings, thus effectually avoiding accidents for all time to come at such points. * * *

When there are ponds of water along the track which cannot be drained off, it is a good plan to locate the fence next to the track rather than fence them in, for when stock want water and there is nothing to prevent them from getting it but a fence, generally they will go through or over it to attain their object, and man has no right to tempt animals with either food or drink. This is only another good reason for keeping the right-of-way as nearly as possible free from water and such vegetation as any kind of stock might naturally crave.

Fire Claims.—In a prairie country where a running fire can sweep over a large territory there should be good safeguards plowed not later than June each year. This requires not less than four furrows, and to further guard against the possibility of fire breaking over them, two or three swaths should be mowed with scythes or mowing machines next to the furrows while the vegetation is still green, and as soon as sufficiently dry it should be burned. Guards, to be effective, should be far enough from the track so that the prevailing wind will not carry the sparks from a locomotive beyond them. This work can usually be accomplished at a nominal cost if the track men will make it a point to gain the friendship of the farmers and stockmen along their territory. As a rule, this is easily attained if only gone about it in the right way. Of course they must be paid a fair price for the use of their teams or for any hay or grass which it was necessary to destroy.

In places where the growth is very heavy and much valuable property is exposed, it is a good plan to have a couple of farmers haul water and keep right along with the burning gang. In western Kansas they would order a work train with four or five water cars and keep them with the burning gang, consisting of 12 to 15 section men, and probably the same number of stockmen, and if the wind was favorable, fire both sides of the track at the same time beating out the back fire with wet gunny sacks or by dragging green cow hides, weighted down with a small log or piece of bridge stringer, over them. With a few swift ponies, green hides weighted down and attached to long ropes can be dragged over a fire when it gets beyond control of section men and subdued very quickly and effectually. Also the blow-off cock on the work train engine can be brought into play in an instant and a stubborn fire smothered out in its incipiency. In this way, by having water always at hand and plenty of help and facilities for keeping fire under control, good safeguards can be burned at the rate of 10 miles per day, and considering the value of the property exposed the cost of the guards in comparison is a mere bagatelle.

In a prairie country the mechanical department should provide some sort of spark arrester on all locomotives during the late summer and fall, and firemen should be required never to use the "shaker" when passing hay or grass land if it can possibly be avoided. On many of the western lines oil is used exclusively as fuel in locomotives and since the advent of the oil burners fires are practically unknown, though occasionally a piece of hot brick will drop from the arch with which all oil burning locomotives are equipped and unless the ash pan stops it, a fire is likely to be the result. In rare instances the sand used under forced draft for cleaning the soot out of the flues becomes so hot it will ignite the dry grass and weeds with which it comes in contact, therefore when practicable this cleaning should be done when passing plowed fields.

Injuries to Track Employees.—To the end of guarding against injuries resulting from carelessness, negligence or ignorance, the roadmaster should use extreme care in selecting sober, competent, careful foremen to place in charge of the work, and, in addition to requiring each one to produce unquestioned reference as to his character and ability, he should subject him to a rigid personal examination to make sure that he not only possesses the necessary qualifications, but that he is fully alive to the responsibilities which attach to the position of section foreman. The roadmaster should fully appreciate the importance of furnishing nothing but first-class hand and push cars and the best and most approved tools that money will procure and that same are kept in safe condition for use at all times. The details of course must be looked after by the foreman, but the roadmaster can impress his men constantly in this respect by taking advantage of every opportunity to inspect the tools personally, calling their attention to any defects which might result in injury to himself or men. Nowadays section laborers, as a rule, are ignorant foreigners and they rely on the foreman entirely to keep them out of trouble. The foreman should take special pains to instruct each man thoroughly in the proper use and handling of each tool and if there is any possible danger by reason of defect or improper handling he should be positive the man fully understands it. This is a difficult matter when dealing with a man whose language is not understood and who probably does not comprehend a word said. Yet, in spite of this, by being patient and persevering, giving object lessons and making signs, much can be accomplished in a very short time. The trouble with many foremen is that they have no sympathy for any man who is so unfortunate as to be unable to speak "United States" and they care very little, or not at all, whether he is crippled or killed in the discharge of his duty. This is all wrong and roadmasters should be very careful not to employ such a man.

Some of the more common kinds of carelessness are, running hand cars in foggy weather or at night without flagging in the way prescribed by the book of rules; going through tunnels, crossing long trestles or running around curves where the view is obstructed without proper flag protection; overloading hand cars and running them at high speed down hill or with the aid of a sail, or attaching a hand car to a moving train, any one of which brands of carelessness will result in trouble if persisted in. An inexperienced or careless spiker is almost as dangerous a proposition as a machine gun or an air ship and a man of this kind should be compelled to use care or spike in a "gang by himself" until he has acquired the necessary skill.

When handling of rails or other heavy materials one man should do all the talking and give the necessary orders and when practicable, this man should be the foreman. Instead of this, many times there are two or three men trying to be "boss" and the result is often broken fingers and toes, and sometimes these useful members are entirely severed and there is very seldom the slightest excuse for such accidents.

In gravel pits and rock quarries where explosives are used and there is danger from caving banks or premature explosions, a good way to prevent personal injury is for the foreman to make it a rule never to require a man to do any work or place himself in any position where he could not cheerfully and confidently go himself. The same is true when working at fires, wrecks and washouts, but many foremen and roadmasters (like illustrious military heroes who have attained

ripe old age without an honorable scar), pick out a position where there is no possible danger to themselves, then order the other fellow to go in and do the real work and assume all risks; then if the venture turns out successfully, they claim all the credit in sight, and if the reverse, disclaim all responsibility and place the blame on the under dog.

Very often men are injured when working around steam shovels or work trains because of poor judgment (and occasionally viciousness) on the part of the engineer or conductor starting a train without sufficient warning, or no warning whatever. The foreman, of course, is culpable in allowing such bad practice. In this connection it should be pointed out that the real blame often rests with the trainmaster in assigning the youngest and most inexperienced conductor and engineer on the division to the very important position of running a work train instead of selecting "old heads" for the work; with the result that these youngsters in their efforts to "make" or "smash" records made by their predecessor take desperate chances. They work up too close to another train's time, back up too fast, stop too sudden and start without giving the men sufficient time to get on board, or to pick out a safe place to sit or stand; and in case of a derailment from striking stock, breaking in two, etc., it is the poor awkward "Jerry" who gets it.

"Smoking" over the road is a much commoner practice with work train crews than the division officials ever dream of in their philosophy. This simply means running from one point to another without proper orders or flag protection, depending on seeing the other fellow's smoke or he yours in time to prevent an accident, and when this reckless practice results in a collision, the laborers very seldom have warning and are slaughtered like sheep.

S. B. Rice (*R. F. & P.*).—When we have stock killed a state law compels us to have our supervisor select a man, and the owner selects one, to agree on the value; if they cannot agree they call on a third man. We have always had to pay two prices, as we have to depend upon the men along the line. A steer killed not long ago was assessed at $100 and the man was paid $95. He took the money and bought a pair with it, either one as good as the animal killed. Now when we have live stock killed I ask what taxes are paid on them. I frequently find an animal listed at $15 that is assessed to us at $90. If the owner says he does not know what it is listed at I suggest our getting the figure from the assessor. They frequently agree to take as little as $25 for a claim of $90.

W. M. Camp.—It is a law in some European countries that where property is destroyed by fire or negligence the owner cannot collect by law any more damages than what the property is assessed at. That would be a good principle to apply in this country.

C. N. Johnston (*C., B. & Q.*).—Quite recently our road has sent notices to farmers to keep their gates closed, otherwise they will be held responsible for all damage that might occur by the gates being left open.

E. E. R. Tratman.—An electric road in Illinois put up a woven wire fence and the farmer was required to maintain the fence. The end of the fence was connected with an old fence and in the course of time the end panel gave way. One night three valuable colts got through on to the track and were all killed by an electric car. The farmer went to town the next day to begin proceedings, but the railroad company brought in the claim that he had not maintained the fence, and he had to stand the loss.

E. A. Hansen (*C. & N.-W.*).—So far as cattle guards are concerned, I never knew but one that would answer the purpose, and that was the old style pit guard that was done away with years ago. We haven't to-day a guard that will turn stock. All stock of the larger kinds, such as horses and cattle, will walk over surface guards. It is up to us to try to pick out the very best guard on the market and see if we cannot make some improvement whereby we can say that we have a cattle *guard*. I do not believe that any road has to-day an absolute cattle guard.

H. Ferguson (*G. T.*).—At a meeting of this association five or six years ago our government appointed a commission to come here to see what kind of cattle guards you had here; and since that time we (the commission) have been all over to see if we could not find a cattle guard that would turn cattle. The commission sent notices out to all inventors to come to Ottawa and bring the best cattle guard for a trial. The commission had a one-eyed steer and they used to put hay across the cattle guard and start the steer up. He went over every cattle guard except one, and he laid down on that one, so it was condemned with the rest. They have been at it ever since and have not found a cattle guard that will turn cattle. We are using the wooden slat on the Grand Trunk. We do not claim that it will turn cattle, but it will do as well as any on the market.

Taking up the second section of the report—fire claims—Mr. Rice said: In Virginia the state law is that if we have our right-of-way clean of combustible matter and our engines properly protected with spark arresters, we are not responsible for any fires on our right-of-way.

Mr. Ferguson.—Our government has appointed a commission and issued special instructions to all the railroads concerning the protection of wooden bridges from April to November. We have to burn the grass at a certain time all around the bridges, and have the trackmen walk the track twice a day and examine the bridges; and if anything happens the section foreman has to stand trial.

A paper on "Some Comparisons of Wood and Steel Ties" was read by J. M. Meade, Engineer of the Eastern Grand Division of the Atchison, Topeka & Santa Fe. Mr. Meade said in part:

"The question of relative age and cost of steel ties and creosoted wood ties is of interest to all maintenance men. Reports from England and France show that steel ties last from 18 to 23 years in those countries. The life of creosoted wood ties in this country is estimated at 30 years. An up-to-date steel tie weighing 160 lbs. is worth, at the present time, about $2.50, against 80 cents for the best creosoted wood ties. Experience in this country with steel ties is yet too limited to say how long they will last, but it is safe to predict that it will not be much, if any, longer than in England and France.

"An interesting account was recently published by W. Morcom, General Manager of the Mexican Railroad, about the steel ties in use on that road between the City of Mexico and Vera Cruz. I have been over this road and saw the ties in question. They would not answer for the heavy rolling stock of this country. They weigh 110 lbs. and the rails are fastened by steel wedges, which all American track men are afraid of. These ties are 8½ ft. long and 14 in. wide. They cost $2, gold, at Vera Cruz. The first of these ties were put in the track in 1884. I saw them two years afterwards. The account above referred to shows that 90 per cent. of these ties are still in use and in good condition, making them 24 years old. This is the best record as to life of any steel ties I know of. They are largely in a dry and mountainous country.

"This report brought out the important point that steel ties do not do well with rock ballast on account of breakage, but do best with gravel or ballast of that nature. It also showed that steel ties must be spaced about like wooden ties; that is, the same number is required to a rail length, experiments having shown that 12 or 13 steel ties to a rail length are not sufficient, as they broke at the rail seat. When the number was increased to that of wooden ties this breakage ceased. This report also showed that the life of these steel ties has been prolonged by a treatment of hot tar before they were put in, and subsequently repeating the treatment.

"From the best data we can get at the present time the life of the creosoted wood tie is ahead of the steel tie, with the cost of the latter more than double. With many ad-

vantages in favor of the wooden tie and with the adoption of thicker and broader tie plates, placed on every tie, or both curved track and tangent to protect the tie against mechanical abrasion, the life of the creosoted wooden tie will no doubt exceed that of the steel six or eight years."

Following this W. M. Camp (*Ry. & Eng. Review*) read an article entitled "Steel Ties on the Bessemer & Lake Erie," which was printed in his journal June 6, 1908.

J. M. Meade.—The Santa Fe has within the last two years been using a large amount of eucalyptus ties from Australia. They are also getting some hardwood ties that look exactly like the American white oak; I don't remember the name, but they are from Japan. These ties cost, delivered at San Francisco, $1.25. They come by water, and on those from Australia there is a duty of 15 cents per tie, which we want to get changed if we can. We get some from the Hawaiian Islands, without any duty on them. Those that come from the Philippines, although under the jurisdiction of our country, still maintain the duty, and the same is true of those which come from Japan. They all seem to be about alike, 15 cents a tie, making the cost of the imported wooden ties $1.40.

My idea is that there is hardly a roadmaster living now who will see steel ties come into universal use, for the reason that they are too expensive, and if we can get the forests reproduced on the lines that some of the railroads have started, it certainly does not seem to indicate that we are going to run short of wooden ties.

We have recently been experimenting with wooden dowels, and I have some samples here. We sent a man to the old country, and this is one he brought back. He has in Topeka among his tie specimens a creosoted tie that was taken out of a track in France. It had been in the track for 26 years, and had one of these dowels in it, as good as when put in, and I would guess that that tie was good for ten years' service. We have bought a lot of these wooden dowels, and the screw spikes that go with them, and put them in about a year ago. A few months ago, in Missouri, we made another experiment with them and we have received orders to put in 20 miles of that kind of fastenings. We regard it as the best form of construction for fastening the rails to the ties, and there is very little more expense than the ordinary track spike.

Mr. Camp.—I recently obtained some new information in regard to tie cultivation. Down in South Africa they have been cultivating ties for six years, rather experimental at present, but they have a grove of 5,800 acres. They are planting their groves with pine and eucalyptus, and they expect to begin to hew ties in about 50 years. They intend to thin out the trees and cut fence posts and telegraph poles before that time. The Pennsylvania Railroad has eight or ten groves of young timber growing for ties. They have two varieties of locust, yellow and black, and also some pine and oak. The chief engineer said the insects are killing their trees, and since this trouble had begun they investigated and found out that that was the common experience with locust trees; that when they became about so old it was difficult to protect them against the insects. The Pennsylvania requires 4,000,000 cross ties every year to make its renewals. He said he did not think the forest would amount to much because they would have to wait about 40 years before beginning to hew ties, and even then it would require larger forests than they could ever think of planting. He seemed to think that their experiment in tie cultivation would not succeed, and said, "The steel tie has got to come."

Mr. Meade.—That section of California where the Santa Fe has planted its tie grove is all under irrigation. Where they get the benefit of irrigation I do not believe the roads will have to wait over 15 or 20 years. The Santa Fe used last year three million ties in repairs, and they are working on that basis in putting in so many hundred acres a year, so that these trees will come in so many each year after they commence to cut them.

F. R. Layng (B. & L. E.).—Referring to Mr. Camp's paper, steel ties are used on the Bessemer & Lake Erie for any purpose whatever in new construction, laying them on the surface of the ground and raising the track with jacks from 1 to 8 ft.; in new cuts, or on dumps, or in fact any place where a tie is needed, and inasmuch as a large part of the construction work of this road is done between November and June, it can be seen that the ties are given a thorough test. No distinction is made in the use of the steel tie in maintenance work. If one tie is to come out of the track, a steel tie is put in its place, or if several wooden ties are to come out the steel ties replace the wooden ones.

During the time the steel ties have been in there have been some 30 derailments on them. Some of these derailments were loaded cars of ore, some coal, and a few included our standard road engines. In no case where the ties were filled in with ballast has the damage to the track structure been greater than it would have been on wooden ties, and in several cases the fact that we had some steel ties in the track has been a material help in opening the track. One instance will illustrate: A train of 39 cars of ore was going down a 40 ft. grade when a flange in the middle of the train broke and 16 cars were derailed. The train ran 1,600 ft. before stopping and the 16 derailed cars piled up in a distance of 300 ft. The 11 rear cars and a caboose were not derailed. The ties in the 1,600 ft. over which the derailed cars ran were wood, about five years old, mixed in among which were four or five steel ties to each rail length. The track was ballasted with ashes and well filled up. Every wooden tie was broken, but the steel ties, while bent and the clips loosened, held the track so that an engine went down over it and pulled 11 cars and the caboose back. There is no question that if the steel ties had not been there the whole train back of the car with the broken flange would have been derailed, and before any cars could have been picked up it would have been necessary to have built over 1,000 ft. of track.

We regard track laid with steel ties much superior to wooden tie track for the following reasons:

(1) It holds line and surface better. It holds surface better because all ties are of uniform thickness, of uniform strength, uniform spacing and each tie gives a uniform bearing on the ballast. Steel-tie track holds line better because the fastenings give an intimate connection between rail and tie. In construction work we find it impossible to throw steel-tie track more than a few inches at a time in one place, and if the track is thrown several feet it is necessary to loosen up the bolts.

(2) The track is always to gage.

(3) Rail wear is more uniform. This necessarily follows if the statement in regard to line and surface is correct, and also on account of the rail not cutting into the tie and canting.

(4) The tie clips act as an excellent anti-creeping device. This is particularly so when the angle bars are slotted and the clips fit in the slots.

(5) Steel-tie track makes a much neater appearance.

(6) Steel-tie track gives a quieter riding track than wooden ties.

(7) It costs less for labor in maintaining steel tie track than wooden tie track. This is not only so on account of the track remaining in line and surface better, but there is also a material saving in not having to tear up a considerable portion of the track each year to make tie renewals.

Steel-tie track which has been in service almost eight years shows very little deterioration from rust and practically no wear where the rail rests on the tie.

The bolts on our steel-tie curves are examined every three months and we have not yet found a bolt that has been

sheared off by service. In fact, we do not hesitate to say that the fastening now in use is stronger than any spike of any kind that has ever come to our notice. While we do not feel that as yet we have an ideal fastening, we do know that we have one that meets the severe conditions to which it has been subjected on this road, and there is no objection that can be raised against it that is serious enough to prohibit the adoption of the steel tie on its account. The supervisors and foremen prefer the steel tie to the wooden tie, and they invariably ask for steel ties. We expect to use the steel tie on a still larger scale in the future than we have in the past.

ELECTRIFICATION OF MELBOURNE SUBURBAN LINES.*

BY CHARLES H. MERZ, M. INST. C.E.

III.

In view of these calculations and the other considerations already given, I recommend an acceleration of 0.92 miles per hour per second, or 1.35 ft. per second per second.† This acceleration is about the maximum possible with the weight and arrangement of coaches proposed; in order to facilitate inspection, to reduce the cost of repairs and to enable the maximum benefit possible to be obtained from multiple-unit operation, I propose to have an equal number of motor coaches and trailer coaches, and to install motors on one only of the two bogies of each motor coach. I may also mention that with side doors—which have many advantages, especially in this case on account of the large amount of existing stock suitable for conversion to electric coaches—a much higher acceleration would not materially improve the schedule speed as, on account of the difficulty of shutting the doors while the train was starting, a longer stop at every station would be necessary.

The general principles hitherto discussed apply to electrical operation whatever the system—whether locomotive or multiple-unit, third rail or overhead wire, direct or alternating current—the selection from these of the particular system to be adopted requires a close consideration of the relative capital and annual costs and of the practical question of which system is the most appropriate to the local conditions.

Having decided on the schedule speed and acceleration, I have investigated fully the details of a suitable motor and control equipment for your service and, from the characteristic curves of such an equipment, I have calculated the actual running speeds which would be attained in practice between each station and the next for both directions, taking into account the gradients and curves which occur in each case. These curves illustrate the way in which the train would actually be handled by the motorman in practice in order to get the most advantageous results.

I may here point out that the order in which matters are dealt with in this report has been chosen as a convenient one in which to give my recommendations and calculations rather than as representing the exact procedure adopted in arriving at the conclusions. For instance, it is not possible, as already stated, to arrive at a final conclusion as to the schedule speed to recommend without estimating the capital cost of the different parts of the scheme, the cost of power and the other operating expenses. No one question can be settled by itself and it is necessary to keep the general problem always in view.

If the suburban railroads be converted to electric traction, I recommend the adoption of the multiple-unit system of train operation. This system consists in making up every train of so many coaches or sets of coaches, each a duplicate of the other as regards motor equipment, but so arranged as to be all controlled electrically from the driving cab of any coach irrespective of its position in the train; normally the train is driven from the coach which, for the time being, occupies the leading end. In other words, each coach or set of coaches making up a unit is complete in itself; it has its own motor, its own control equipment, its own driving cab, its own air compressor for the brakes, and can, therefore, be operated either by itself or in conjunction with any number of other units similarly equipped.

One advantage of this system compared with using an electric locomotive to draw a train in the ordinary way, as with steam traction, is that a train of any desired size can be made up with a certainty that the motor equipment will be ample to draw it and that the efficiency will be substantially the same whether the train be large or small. A locomotive, on the contrary, is designed for a given speed and weight of train, and if, as in operation is often the case, only a few coaches are required, an unnecessary amount of dead weight has to be hauled with no corresponding advantage. If, on the other hand, due to stress of traffic the weight of the train needs to be increased, the locomotive being chosen for the normal size of train is either incapable of hauling the heavier train or can only do so at a reduced schedule speed just when a high speed would be of most advantage.

Another great and important advantage of multiple-unit operation as against locomotive operation, especially for suburban work is that at crowded termini, when the direction of the train has to be reversed, it is only necessary for the motorman to change into the driving cab at the reverse end—no shunting of a locomotive being required. Again, if it be desired, owing to variations of the amount of traffic, to reduce the capacity of any train, the unnecessary coaches are uncoupled and the reduced train proceeds into traffic, the uncoupled portion, operated from one of its own driving cabs, being run into a siding without the aid of any shunting locomotive. The advantages of multiple-unit operation may be summarized as follows:

1. Each set is a complete unit of itself; a train consisting of any number of units may be operated in exactly the same manner as a single unit, and from any driving cab on the train.
2. The adjustment of train capacity from time to time throughout the day to suit variations of traffic is made practicable—no shunting locomotives being required.
3. Shunting at termini is abolished—thus increasing station capacity and reducing the number of train and signal movements by at least one-half.
4. A uniform schedule speed can be maintained irrespective of the size of train, and a close headway made practicable as the power available on the train is directly proportional to the number of motor coaches.
5. Trains can be reversed on any cross-over road and the rolling stock concentrated on a busy section of the line.
6. The cost of motive power is made proportional to the paying load by adapting the capacity of the train to the traffic demands.
7. The marshalling of trains is simplified.
8. The number of driving wheels, and consequently the adhesion, is directly proportional to the length of the train; therefore a high limit of adhesion can be worked to; in other words, the ratio of useful weight to total weight moved is high.
9. The weight is distributed over the entire train instead of being concentrated in a locomotive.

Multiple-unit operation, carried to the extreme limit, consists in making each coach complete in itself, with its own motors, compressors, driving cabs and complete control equip-

*Abstract of the Report to the Victorian Railways Commissioners on the Application of Electric Traction to the Melbourne Suburban Railway System. Published by the courtesy of the Commissioners.

†This is, of course, the acceleration on the level—it is somewhat lower on the up-grades and somewhat higher on the down-grades; the exact figure to be finally adopted in practice is dependent on the particular motor chosen.

ment, the other extreme being to have either one motor coach per train or a locomotive. In the case of Melbourne, I recommend that normally the trains should be made up of an equal number of motor coaches and trailer coaches; that is to say, of a number of two coach units, each consisting of one motor coach and one trailer coach.* This arrangement secures the full advantage of a multiple-unit system with a reasonable number of motors and, consequently, with economy of capital cost and of operating expenses. On outlying routes the traffic can be dealt with at certain times of the day by a single-coach train, and for this purpose a certain number of motor coaches would equipped with driving cabs at both ends. In general, however, the trains will consist of either two, four, six or eight coaches.

Having, on general principles as applied to Melbourne, settled on the schedule speed at which the equipment will have to operate, on the acceleration, and on the general system of

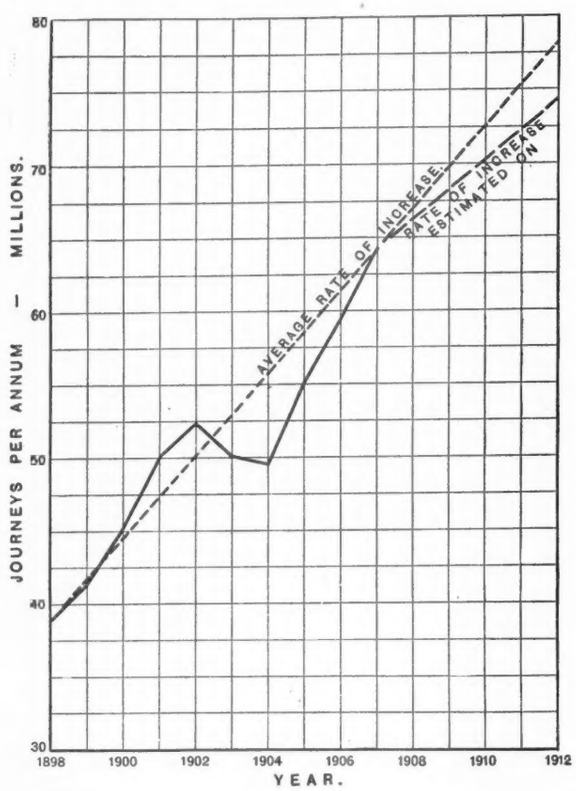


Fig. 1.

train operation, it remains, before we can efficiently discuss the system of electric traction to be adopted or consider any estimates of capital or annual expenditure, to decide on the train service required to handle the traffic. Very complete data has been furnished for the year 1906, both as regards traffic and as regards operating expenses, and as the 1906 figures have been adopted as a basis for comparison in various places throughout the report, it will be well to take these as a basis for estimates of traffic also.

Fig. 1 shows the growth of the passenger traffic on the suburban system from the year 1898 to the present time, and shows by a dotted line the estimated traffic during the next few years if the traffic were to continue increasing at the same average rate. Even if one were to start converting the lines to electric traction at once and were to decide to proceed with the whole scheme, it would probably take three years to make the change. The year 1912, therefore, would be the first complete year of electrical operation, and it is obvious that all estimates of financial results should be made on the basis of the traffic at that time and not on the basis of the present traffic. From Fig. 1 it appears that the traffic for 1912, if the rate of increase were to continue at the same average rate, would be 31.5 per cent. greater than for the year 1906. It was decided, however, after a full discussion in Melbourne, that all estimates of traffic with electrical operation should be based on a 25 per cent. increase, compared with the year 1906, and the electric train service proposed is, therefore, arranged to be capable of dealing with such a traffic.*

Table I shows, in actual figures, this estimated increased traffic with electrical operation by the year 1912.

In view of the rate of increase in the past and the further

TABLE I.

Traffic on which Proposed Time Table is Based.

Route.	Passenger journeys. Millions per annum. 1906 steam service.	1912 electric service.	Receipts. 1906 steam service.	1912 electric service.
Port Melbourne	1.34	1.68	£15,500	£19,375
St. Kilda	3.64	4.55	34,500	43,125
Sandringham	10.47	13.09	110,500	138,125
Broadmeadows	5.75	7.19	60,950	76,188
Williamstown	6.62	8.27	61,000	76,250
Ringwood (including Kew, Darling, Ashburton and Deepdene)	9.99	12.49	127,950	159,937
Coburg	2.11	2.64	8,500	10,625
Sunshine	0.57	0.71	2,600	3,250
Preston, Heidelberg & No. Fitzroy	7.53	9.41	49,500	61,875
Dandenong and Mordialloc	10.58	13.23	101,650	127,062
Totals	58.60	73.26	£572,650	£715,812

increase which is certain to result merely on account of the adoption of electric traction and the better and more frequent service which will be provided, I consider this a conservative estimate, and it might be even suggested that I have not allowed for sufficient increase in traffic. My reply is that the greater the traffic on any given line the more favorable will be the comparison between the costs of electrical operation and steam operation.† If, therefore, when we come to deal with the estimates, we make a comparison between the costs of the two systems on the basis of a traffic somewhat smaller than we may reasonably expect to reach, we shall at any rate be on the safe side.

(To be continued.)

WAGES IN GERMANY.

The upward course of wages is indicated sharply by a new scale for Prussian government employees submitted to the parliament in October by the Minister of Finance. All the lower offices have an advance of at least 200 marks ($47.60) per year. The lowest grade of railroad employees on entering the service will have at least 1,000 marks, instead of 800, as heretofore. The new rates require an addition of more than $20,000,000 to the government's expenses, more than half of which goes to State Railroad employees. These advances were granted when times were prosperous, and now first appear in the budget. As in other countries, they are regarded as inevitable, and not to be rescinded by a temporary falling off of traffic and earnings. The estimates are that the Prussian railroads will yield net $30,000,000 less this year (ending with March next) than last, and no improvement in the following year is looked for. Any increase in earnings will probably be absorbed by increased expenses.

*Except where arranged to operate only in four and six-coach trains on the heavy sections of the system, the trailer coaches will be provided with a driving cab; all motor coaches will be provided with at least one driving cab.

*The increase in passenger journeys is assumed to be 25 per cent., both during hours of rush traffic and during the slack periods of the day.

†The cost of operating that system wrich has the greater fixed charges and smaller variable charges obviously goes up less rapidly with the increase of business than that of the system whose operating expenses consist of smaller fixed charges and greater variable charges. I have already referred to the increased capital charges with electrical operation compared with steam operation.

THE BALDWIN SMOKEBOX SUPERHEATER.

The Baldwin smokebox superheater, which was illustrated in the *Railroad Gazette* June 7, 1907, and March 27, 1908, has now been in service for a sufficient time to indicate the economic results that may be expected from its use. Reports have been received to the effect that the actual saving obtained in working conditions amounts to from 10 to 15 per cent. in fuel and from 8 to 12 in water consumption, depending upon the service. The figures are not taken from isolated tests alone, but appear from the records of road service which is, after all, what really counts. The average increase in hauling capacity with superheater locomotives amounts to conservatively 10 per cent.

The increased efficiency with superheated steam engines is most noticeable in passenger service. These engines pick up a train quicker, handle it better, and can haul a larger tonnage than saturated steam engines of the same size and type.

The advantages claimed for the smokebox superheater are that it merely takes the place of the steam pipe in the smokbox, the numerous coils of tubes serving to detain the steam on its passage from the dome to the cylinders long enough to heat it thoroughly, there is no modification necessary in the boiler construction, no reduction in heating surface, and the apparatus can be placed in old as well as new engines.

The latter feature, the availability of the apparatus for old engines, is an important consideration. The Baldwin Locomotive Works recommend, with their superheater, a boiler pressure of 160 lbs. per sq. in., as the most satisfactory, and from every point of view the most economical. The use of a higher boiler pressure, while giving a higher tractive power, involves a theoretical reduction of efficiency, the point of maximum economy being found in a boiler pressure considerably lower than even 160 lbs. The compromise between maximum economy and maximum efficiency has generally been fixed at not less than 160 and not more than 180 lbs. pressure, for single-expansion engines. The increase of pressure, however, involves a large increase in boiler repairs, and as the cost of boiler repairs is probably more than 75 per cent. of the total repairs upon a locomotive, the cost of maintenance is greatly increased by the higher boiler pressure. It is for this reason that they recommend 160 lbs. pressure, as well as to make use of the greater specific volume of superheated steam. With this decrease in boiler pressure, it is also recommended that cylinders of proportionately larger diameter be applied to the locomotive, in order to maintain a tractive power equivalent to that secured with a boiler pressure of 180 or 200 lbs. Here again the properties of superheated steam—of greater specific volume and more complete gasification—appear as important advantages when the superheated steam is used in cylinders of large volume.

The life of an old engine whose boiler plates are worn, and whose flues are leaky, as a result of high steam pressure, is increased by the use of the combination of cylinders of large diameter, 160 lbs. pressure, and smokebox superheater. Also the cost of repairs on a new engine so designed will be reduced.

The tubes composing the superheater are made of the best seamless drawn steel. The tubes are carefully expanded into tube plates, all the parts are accurately fitted together, thoroughly steam tight joints are assured, and they are not affected by the heat while steam is not passing through the superheater tubes. Furthermore, there is no loss of efficiency in the superheater on account of becoming clogged with soot and cinders.

The apparatus is easily removable from the smokebox. In actual practice, it has been removed and reinserted inside of three hours. Therefore, the operations of tube cleaning and renewing, as well as any repairs that may be necessary to the superheater itself, are not seriously affected.

As this superheater simply takes the place of the steam pipe in the smokebox, it is easily applied. All that is necessary is to open the smokebox front, slide the superheater in, and connect the drums with the double cone and the live steam passages. Practically no repairs are necessary to the superheater itself, and should occasionally a superheater tube become worn from the action of cinders, owing to an incorrectly arranged deflecting plate, it is a simple and easy matter to open the smokebox front and replace the flue.

One of the recommendations of the device, lies in the fact that it adds no complication whatever to the running of the engine as it simply takes the place of the steam pipe, no dampers or levers are involved to require the attention of the engineer.

A curious instance of the lack of attention on the part of the roundhouse staff, required by this apparatus, is reported. The first Baldwin smokebox superheater was applied a few years ago, on one of the large western railroads to a tandem compound locomotive, whose high pressure cylinder was removed; the engine being worked as a single-expansion with the low pressure cylinders, which were 32 inches in diameter. The boiler pressure was reduced to 130 lbs. and afterwards increased to 160 lbs., as it was found the engine would take this pressure without slipping. A perfunctory test was made, and then the locomotive was lost sight of by the officials of the road. Even the superintendent of motive power of the division on which the engine was operated, was not aware that there was anything especial in the smokebox of this locomotive. A year, eighteen months, two years passed by, and the engine continued to do its work day after day. The vice-president of the road, in whose jurisdiction lies the motive power department, keeps a close supervision of the performance sheets of all his engines. He began to notice that this engine had a greater ton mileage, fewer shoppings, lower fuel consumption and less repairs than any similar engine. He traced the matter to the bottom. There he found the superheater. Now every engine he buys must be equipped with a superheater.

There is one more consideration worthy of attention in connection with the Baldwin superheater. The Baldwin Locomotive Works believes firmly in the advantages of moderate superheat; that is, 50 to 100 degrees Fahrenheit, over high superheat. High superheat can only be obtained by running a large flue entirely through the boiler, and, it may be, placing the superheater in or near the firebox. It is maintained that a high degree of superheat aggravates losses due to radiation, insufficient lubrication, leakage of valves and pistons, wear and tear of parts, and the liability for steam being exhausted from the cylinders with a larger amount of heat remaining after expansion than would insure the greatest economy. Therefore, high superheat, obtained either from a single large flue or a number of large flues through the boiler, does not secure the maximum efficiency of which the boiler is capable, first, because the gases escape from the stack at a high temperature without doing their full amount of work; second, because the large superheating flues displace the boiler flues and thereby reduce the heating surface by so much. Furthermore, high superheat involves the use of complicated devices in combination with valves, pistons, boiler flues, fireboxes and smokeboxes, all of which tend to increase the liability to failure, obstruct the draft, and make inspection and maintenance inaccessible and costly.

A feature of moderate superheat is that the lubrication of the cylinders is not burnt out, and there is no injury to piston rings and valve packing. Locomotives with moderate superheat show a saving over corresponding saturated steam engines in the use of valve and cylinder oil, due to reduction of amount of water of condensation in the cylinders. The superheat is not so high as to burn out the oil, consequently no specially constructed lubricators are necessary with moderate superheat.

There remains but to mention, before closing, a special field

in which superheaters are useful, in fact, almost a necessity. It has been found by experience with Mallet articulated compound locomotives, and two-cylinder compound locomotives, that the water of condensation in the low pressure cylinders, is so great as to seriously impair the efficiency of the machine. In Mallet locomotives water will work through the valves and cylinders, and in addition to the damage from this cause, will get upon the rails and make the forward group of driving wheels slip. The only way to correct this is by the application of a superheater to raise the temperature of the steam after it has been used in the high pressure, and before it goes into the low pressure cylinder. A low superheat is sufficient to avoid this condensation.

Summing up, the following conclusions concerning the use of superheated steam in locomotives, have been drawn:

(1) By the use of superheated steam in locomotives, a substantial reduction of steam and coal consumption, besides an increase in hauling capacity, can be effected.

(2) The main sources of steam economy and, consequently, of fuel economy, and of the augmentation of hauling power, are in the increased volume, the reduction of cylinder condensation and the low thermal conductivity of superheated steam.

(3) The total economy in water in a superheated steam locomotive amounts to 15 to 20 per cent.

(4) The economy in fuel is larger than the economy in water, because only waste gases are used to superheat the steam. The saving in fuel effected is 10 to 15 per cent.

(5) This saving in coal is an equivalent to an increase in boiler capacity. In other words, for equal quantities of fuel consumed, the superheater locomotive produces more indicated horse power than a similar saturated steam engine.

(6) An increase in the indicated horse power represents a gain in drawbar horse power or hauling capacity of 10 per cent., and more at high speeds.

(7) The cylinders of superheated steam locomotives are usually made larger than those in ordinary engines, in order to make use of the increased capacity of the superheater boiler, with economical cut-offs in the cylinders.

(8) The increased cylinder volume permits of a reduction in boiler pressure to say 160 lbs. This is an advantage from the point of view of economy of maintenance, as well as of efficiency.

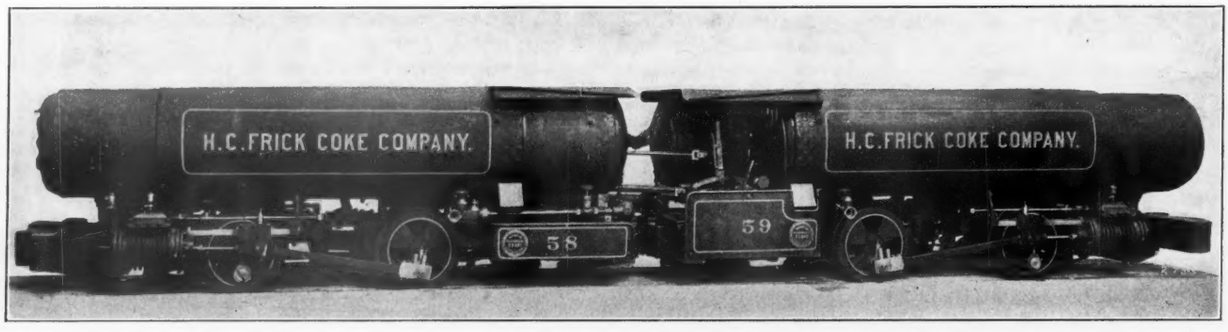
(9) The efficiency and steaming capacity of a locomotive boiler are materially increased by the application of a smokebox superheater.

(10) In the case of Mallet and two-cylinder compound locomotives a low superheat suffices to avoid all losses by condensation in the low pressure cylinders.

In short, with a moderate degree of superheat, of from 50 to 100 degrees Fahrenheit, the ordinary and more serious losses with saturated steam due to condensation and the working of water through the cylinders and valves, are overcome. The superheat can be obtained from waste gases which have served their usefulness in the boiler proper. These waste gases, in connection with the simple superheating arrangement, can be utilized in the smokebox without restricting the draft. With moderate superheat the cylinder lubrication is not burnt out, nor is there liability of decreasing the boiler efficiency by the use of heat that could better be utilized in generating saturated steam. The smokebox superheater is more accessible and less costly for cleaning, examination and maintenance than any other type. A locomotive equipped with a superheater will haul more tonnage at a lower fuel cost per ton-mile, and with lower cost of repairs, than will any other engine of equivalent size and power using saturated steam.

COMPRESSED AIR LOCOMOTIVES FOR THE H. C. FRICK COKE CO.

The past few years have witnessed the substitution, in many mining plants, of mechanical haulage for animal power, and the theoretical advantages and economies attending such a change have been realized. The form of power to be installed, in any particular instance, must be determined by the local conditions existing at the mine; and these conditions are quite as variable as those found in ordinary railroad operation. The sources of power principally used in work of this character are electricity and compressed air, and while the former is doubtless the more extensively employed, there is a wide field for the latter, especially in cases where it is absolutely necessary to eliminate fire risks.



Compressed Air Mine Locomotive. Built for H. C. Frick Coke Co. by Baldwin Locomotive Works.

The Baldwin Locomotive Works have recently completed eight compressed air locomotives for the H. C. Frick Coke Co. These engines are all practically alike, except that six are designed for a track gage of 3 ft. 6 in., and the remaining two for a gage of 3 ft. 4 in. They are to be employed in a gaseous mine, where the operating conditions require that heavy loads be hauled up grades as steep as 5 per cent., and around curves of 100-ft. radius. Owing to the restricted clearance limits, it was practically impossible to design a single locomotive capable of meeting these conditions; hence the locomotives are arranged to be operated in tandem, as shown in the photograph. The combined weight of the two locomotives is 46,400 lbs., and as the tractive force exerted is 8,160 lbs., a liberal factor of adhesion is assured.

The locomotives, when working in tandem, are coupled together back to back. One operator controls the two units by a single throttle lever, reverse lever, brake valve, etc., and by means of a flexible connection between the air tanks, the locomotives can be charged simultaneously. When the locomotives are in operation, this flexible connection is closed, but the auxiliary air tanks are then in communication through a rubber hose coupling, so that the cylinder pressures on the two units are equalized. This pressure is always maintained by the reducing valves at 150 lbs. per square inch, the initial pressure in the storage tanks being at 800 lbs. per square inch.

The details of construction, as far as frames, running gear and valve gear are concerned, present many features similar

to steam locomotive practice. The frames are of cast steel, of the usual bar form in the middle and narrowed down to a slab section at each end. The air tanks are supported on cast steel saddles, one of which is bolted between the slab frames at each end of the locomotive. The cylinders are cast separately and are placed outside the frames.

Each locomotive is provided with two air tanks, one of which is made shorter than the other in order to allow room for the operator. The circumferential seams are triple riveted, and welded, and futher re-enforced by an inside liner secured to the shell by eight rows of rivets.

The equipment throughout is most complete for a locomotive of this type, and special attention has been given to making the coupling devices simple and positive in action so that the locomotives can be readily operated in tandem. The accompanying table gives the principal dimensions, the figures applying to one unit only:

Gage	3 ft. 4 in.
Cylinder, diameter	8 "
Piston, stroke	12 "
Valve, type	Plain D.
Air tanks, number	2
Thickness of tank sheets	⅞-in.
Working pressure	150 lbs.
Storage pressure	800 "
Tank diameters	31¾ in.
Tank lengths	12 ft. 4½ in. x 14 ft. 9¼ in.
Wheels diameter	24 "
Journals	4 in. x 6 in.
Wheel base	4 ft. 6 "
Weight	23,200 lbs.

FOREIGN RAILROAD NOTES.

The railroads in German Southwest Africa recently advertised in Germany for locomotive engineers. They were to be unmarried, engage for three years, and were to have free quarters and medical attendance, and $1,000 a year pay, rising to $1,140. For outfit $73 was allowed, and the same a year later, and for expenses home $167.

A protest against a further reduction of the number of 10-ton cars in Prussia (which have largely been replaced by 15-ton cars) has been lodged with Prussian railroad authorities by shippers, particularly of coal briquettes and artificial manures, who say that a very large part of their customers never require a consignment of more than 10 tons at a time.

For the eight months ending with August the Swiss State Railroads earned slightly less this year than last, while their working expenses were 8 per cent. greater, resulting in a decrease of nearly 15 per cent. in net earnings. The estimates for 1909, to be laid before Parliament, are for an increase of about 3 per cent. in gross earnings and of 7½ per cent. in expenses, resulting in a decrease of 8 per cent. in net earnings.

On many Russian railroads women physicians have been appointed surgeons of divisions, and as such have to make examinations of the physical condition of employees, who are, of course, nearly all men. Recently the Ministry of Transportation has forbidden such appointments. There is a great lack of doctors in Russia; but of late considerable numbers of women have been educated for the profession, largely in Switzerland, France and Germany.

It is now reported that a recent conference of the railroad authorities of the several German states has made it certain that the State Railroads will pool their freight cars—that these will be used as if common property of all the railroads. The original movement, began some years ago, was to pool the entire rolling stock, passenger cars and locomotives, as well as freight cars, and the repair shops with them. The smaller states feared that this might work to their disadvantage; but the manifest advantages of distributing the aggregate freight car stock according to the needs of the different routes at different times have brought about this combination, which is expected to take effect April 1 next, which is the beginning of the fiscal year of most of the State Railroads.

THE USE OF ELECTRICITY AT THE MOBERLY, MO., SHOPS OF THE WABASH.

A good example of the manner in which electric current can be utilized in replacing small boilers and engines about old railroad shops is shown in some improvements made this year at the Moberly, Mo.. shops of the Wabash.

The principal object of this installation was to enable the company to improve the water supply at Moberly, which had been growing more unsatisfactory for a number of years. As the supply became exhausted during the dry season and between 300,000 and 400,000 gallons were being used daily, it was necessary during five or six months of the year to haul this water 26 miles by rail and empty it into a pond and then repump it for the locomotives and for the uses of the shops. About a year ago the Wabash made arrangements with the city authorities of Moberly to lease some land to be used as a park, the railroad to have the water privileges. A dam was built and a watershed of three or four square miles utilized, and during the rainy season there is stored up enough surface water to last from six to nine months, which provides a surplus for use in the dry period. It was the original intention to operate the pump with a steam plant but the expense of operation together with the long haul of fuel to the pumping plant by a wagon over the hills where there is no roadway, made the project so expensive it was decided to make the electrical installation at the shops and put in an automatic electrically-driven pump at the reservoir.

The power, taken at the shops, is stepped up from 440 volts alternating current to 2,200 volts through the Wagner Electric Company's transformers, and transmitted 2½ miles at 2,200 volts to the pumping station, then stepped down to 440 volts.

The pumping station equipment consists of a Dean triplex single-acting pump, 350 gallons per minute capacity, which is driven by a Wagner Electric Co.'s 25 h.p., three-phase, slip ring motor. It is controlled by a Cutler-Hammer alternating current self-starter and a pressure regulator.

In operation the pump has to work against a head equivalent to 85 lbs. pressure. The tank into which it discharges is two miles away from the pumping station and is controlled with a float valve, so that when the tank is full it closes the float valve, which runs the pressure up so that the automatic device cuts the electric power off. As soon as the water is lowered enough in the tank to relieve the float valve the pressure is released and the pump starts.

The only attention this pump requires is the work of a man who goes there once in every two or three days and fills up the compression grease cups. The outfit has been in service for nine months and is found very reliable. As the service is intermittent, and as there is more or less danger of the pump freezing up in the winter during the period it is shut down, an electric heater is arranged so as to be cut in when the pump is not in motion and cut out when the pump starts up.

The electrical generator also furnishes current for electric lights at the shops, freight house, freight yard and passenger station. It supplies current for motors operating the coaling station, for electrically-driven pumps for the new hot water washout system, and for a motor on the turntable which was formerly operated by a gasolene engine and motors for machine tools in the shop; and it dispenses with the separate steam plant which formerly operated the foundry. The generator is a 150-k.w. Crocker-Wheeler, 440-volt, three-phase, direct-connected to a 15 x 16 high-speed Ball engine. The saving obtained by the use of these improvements is found to be over 10 per cent. on their cost.

The work was done under the direction of W. H. Hopkins, Electrical Engineer of the Wabash.

WORLD MILEAGE OF SINGLE-PHASE ROADS.

The following compilation of information about single-phase electric railroads throughout the world is furnished by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.:

American Summary.

Mileage of single-phase roads	966.5
Cars	246
Locomotives	64
Horse power	137,320

Single-Phase Roads in Europe.

Name of road.	Length of line (miles).	Equipment—Cars—No.	Cars—Motors.	Locomotives—No.	Locomotives—Motors.	Line characteristics.—Voltage.	Cycles.
Westinghouse—							
Brembana Valley Ry.	19	..	.....	5	4-75	6,000	25
Swedish State Ry.	7	..	.....	1	2-150	3,300 / 18,000	25
Roma Civita Castellana Ry.	33	8	2-40	3	4-40	6,600	25
Lyons Tramways	14	15	2-50	..	.....	6,600	15
Midland Ry., England	9	1	2-150	..	.....	6,600	25
Forenade Elektrisk Aktieboget	..	1	4-50	..	.....	6,000	25
Tramways De Salerne from Salerne to Valle di Pompeii	19	20	2-40	..	.....	6,600	25
Thamshavn Ry., Norway	19	1	2-40	4	4-40	6,000	25
Trafford Park Ry.	..	1	4-100	..	.....	3,300	25
Tergnier-Aniay (Aisne-France)	20	3	2-40	3	2-40	3,300	25
	—150						
Siemens-Schuckert Werke, Berlin—							
Murnau-Oberammergau	14	4	2-100	1	2-100	5,500	16⅔
Swedish State Rys.	7	..	.....	1	3-110	20,000	25-15
Rotterdam-Haag Scheveninghen	19	20	2-175	..	.....	10,000	.....
Parma Provincial Ry.	..	10 / 8	2-60 / 1-60	..	.....	.....	.....
Midland Ry., England	9	2	2-175	..	.....	6,600	25
Seebach-Wettingen Ry.	12	..	.....	1	2-200	15,000	25
Roma Civita's Casstellana	33	4	4-40	..	.....	6,500	25
Vienna Baden Ry.	20	14	4-40	..	.....	550	25
Prussian State Ry., Blarkenese-Ohlsdorf Ry., Hamburg*	16.5	6	2-125	..	.....	6,600	25
Royal Prussian State Ry.,Oranienberg Experimental Line	1	1	2-175	..	.....	6,000	25
Mariazell Railroad	..	..	.....	23	2-175	6,000	..
	—131.5						
Allgemeine Elektricitats Gesellschaft—							
Royal Prussian State Ry., Blankenese-Ohlsdorf	16.5	54	3-115	..	.....	6,600	25
Royal Prussian Experimental Ry., Orienburg	1	1	2-175	..	.....	6,000	25
Stubai-Thal Ry.	12	4	4-40	..	.....	2,500	42
Borinage Ry.	13	20	2-40	..	.....	600	40
Swedish State Rys.	7	2	2-120	..	.....	6,000	25
So. London Line, London, Brighton & South Coast Ry.	9	16	4-115	..	.....	6,000	25
Niederschönweide Spindlersfeld Ry.	2.5	2	2-100	..	.....	6,000	25
Prussian State Railway	112	..	.....	..	3-350	6,000	25
Berlin Stadt & Ring Ry.	366	..	.....	..	.....	10,000	..
	—539						
Maschinenfabrik Oerlikon, Zurich—							
Seebach-Wettingen Ry.	12	..	.....	1 / 1	2-200 / 4-250	15,000	25
Locarno-Bignasco	17	3	4-40	..	.....	5,500	20
Valle Moggia Ry.	17	..	4-40	..	.....	5,000	..
	—46						
Miscellaneous—							
Compagnie Generale Parisienne de Tramway	1	1	2-50	..	.....	500	25

*Also known as Hamburg-Altona Ry.

Single-Phase Roads in America.

Name of road.	Length (miles) of line electrified.	Equipment—Cars—No.	Cars—Motors.	Locomotives—No.	Locomotives—Motors.	Type of control used.	Line characteristics—Voltage.	Cycles.	Electric service started.
Westinghouse :—									
Indianapolis & Cincinnati Traction Co.	116	25	4-100	..	.....	Unit switch	3,300 / 550	25 / D.C.	Dec., '04
Westmoreland County Traction Co.	7	4	4-50	..	.....	Hand	1,200	25	Mar., '05
San Francisco, Vallejo, Benecia & Napa Valley Ry. Co.	34	2 / 8	4-75 / 4-100	..	.....	Unit switch	3,300	25	June, '05
Atlanta Northern Traction Co.	18	8	4-50	..	.....	Hand	2,200	25	July, '05
Warren and Jamestown Street Ry. Co.	22.5	6	4-50	..	.....	"	3,300	25	Aug., '05
Long Island Railroad Co.	5	6	2-50	..	.....	"	2,200	25	Sept., '05
Spokane & Inland Ry. Co.	115	21	4-100	6 / 8	4-150 / 4-175	Unit switch	6,600 / 550	25 / D.C.	Nov., '06
Erie Railroad Co.	34	6	4-100	..	.....	" "	11,000	25	Dec., '06
Fort Wayne & Springfield Street Ry. Co.	21.5	4	4-75	..	.....	" "	6,600	25	Jan., '07
Pittsburgh & Butler Street Ry. Co.	33	13	4-100	..	.....	" "	6,600 / 550	25 / D.C.	May, '07
New York, New Haven & Hartford R.R. Co.	22	4	4-150	41	4-250	" "	11,000 / 600	25 / D.C.	July, '07
Windsor, Essex & Lake Shore Rapid Ry. Co.	28	5	2-100	..	.....	Hand	6,600	25	Sept., '07
Grand Trunk Railroad Co. (Sarnia Tunnel)	3.5	..	.....	6	3-240	Unit control	3,300	25	Mar., '08
Visalia Electric Ry. Co.	23	4	4-75	1	4-125	Unit control	3,300	15	Mar., '08
Chicago, Lake Shore & South Bend Ry. Co.	78	24 / 4	4-125 / 2-75	..	.....	Unit switch / Hand	6,600 / 575	25 / D.C.	June, '08
Denver & Interurban Railway Co.	46	10	4-125	..	.....	Unit switch	11,000 / 575	25 / D.C.	June, '08
Hanover & York Street Ry. Co.	20	5	4-75	..	.....	" "	6,600 / 575	25 / D.C.	Feb., '08
Shore Line Electric Ry. Co.	12	4	4-75	..	.....	" "	6,600	25	Und. constn
Maryland Electric Ry. Co.	24	9	4-100	..	.....	" "	6,600	25	Apr., '08
Total	662.5	172	53,700*	62	55,020*				
General Electric :—									
Bloomington, Pontiac & Joliet Ry. Co.	19	2	4-75	..	.....	K	3,300	25	In operat'n
Toledo & Chicago Ry. Co.	43	7	4-75	..	.....	K	3,300 / 575	25 / D.C.	"
Milwaukee Electric Ry. & Light Co.	59	11	4-75	..	.....	M	3,300 / 575	25 / D.C.	"
Central Illinois Construction Co.	80	20	4-75	1	4-150	M	3,300 / 575	25 / D.C.	"
Richmond & Chesapeake Bay Ry. Co.	15	4	4-125	..	.....	M	6,600	25	"
Anderson Traction Co.	20	3	4-75	..	.....	K	3,300 / 575	25 / D.C.	"
Washington, Baltimore & Annapolis Ry. Co.	60	21	4-125	..	.....	M	6,600 / 575	25 / D.C.	"
New York, New Haven & Hartford R.R. Co.	8	4 / 2	2-125 / 4-125	..	.....	M	11,000	25	"
Shawinigan Railway Co.	..	..	.....	1	4-150	M	6,600 / 600	30-15 / D.C.	Und. constn
Total	304	74	27,400*	2	1,200*				

*Total horsepower.

General News Section.

At Bloomington and other principal points the Chicago & Alton is establishing stores departments to take care of stores for the maintenance of way, signal, water, bridge and building departments, together. Heretofore each department has had a storehouse of its own.

The New York Central has asked the New York State Public Service Commission, Second district, for a rehearing of the complaint on which the commission has ordered the company to employ an additional trainman on passenger trains between Lyons and Dresden on the Pennsylvania division.

In the Federal court at New Orleans Judge Saunders has enjoined the Texas & Pacific from violating the Louisiana state law prohibiting non-resident corporations from transferring suits from state to federal courts. The injunctions was issued in the case of the Mercantile Trust Company of New York and Edward Gannon.

A press despatch from Ottawa says that the employees of the Intercolonial Railway holding membership in the International Brotherhood of Railway Employees have severed their connection with that brotherhood, and have organized the Canadian Brotherhood of Railway Employees. According to the despatch, 8,000 men have joined in this movement.

F. O. Becker, Superintendent of the Western Railway Weighing Association, has notified agents and weigh-masters that whenever a car has been weighed at some association point the weight should not be corrected on the waybill unless there is a difference of more than 1,000 lbs. Sometimes a car will not weigh the same at terminal point as it did at initial point, because of the condition of the weather and the inevitable variation of scales.

The Metropolitan Street Railway Co., New York City, having been ordered by the State Public Service Commission to restore a joint 5-cent fare with the Central Park, North & East River Railroad Co., which had been discontinued when the two roads were separated in consequence of the receivership of the Metropolitan, the receivers have notified the Commission that they will disregard the order, having secured from the Supreme Court a writ of certiorari to review the action of the Commission. The Central Park company also refused, on the same grounds as the Metropolitan, both declaring the 5-cent rate for the joint traffic unremunerative.

The Indiana Railroad Commission in its report on accidents for the quarter ending June 30 last referring to the rear collision on the Lake Shore & Michigan Southern at Chesterton, in which an excursion train was struck by another train, killing one passenger, says: "The commission has made careful personal investigation by all of its members of the facts, and will have to find and report that the engineer of the train which ran into the excursion train, and the flagman of the excursion train were guilty of gross neglect in performing their duties, and that the accident could have easily been avoided had these men obeyed the rules of the company."

In celebration of the completion of the Spokane, Portland & Seattle, known as the North Bank road, a dinner was given at Portland, Ore., on the evening of November 7, at which James J. Hill was the guest of honor. Among the other guests were L. W. Hill, President of the Great Northern; Howard Elliott, President of the Northern Pacific; George B. Harris, President of the Chicago, Burlington & Quincy; Francis B. Clarke, President of the Spokane, Portland & Seattle; Darius Miller, Vice-President of the Chicago, Burlington & Quincy; Governor A. E. Mead, of Washington; Governor George E. Chamberlain, of Oregon; Dr. Harry Lane, Mayor of Portland; and a number of other prominent railroad men and citizens of the Northwest.

W. S. Tinsman, Manager of the Choctaw and Southern districts of the Chicago, Rock Island & Pacific, has written a letter to the Corporation Commission of Oklahoma asking whether this road would be permitted to operate a motor car service between Guthrie, Okla., and Chandler, without dividing the car into separate compartments for white people and negroes, a portable partition to be used instead. The motor car service would be used to make connection between trains on the main lines. Mr. Tinsman stated that the motor car system would be installed as soon as arrangements could be made if the Commission ruled favorably. The first cars would have a capacity of 20 to 25 people, and larger cars would be put on when the traffic justified.

The Oklahoma Federation of Commercial Clubs has issued a statement showing that agitation against corporations is hurting the state. For nearly two years railroad building has been at a standstill in Oklahoma although 56 projected lines have been chartered. Prior to the state constitutional convention charters had been issued for 13,128 miles of new railroad. If only 5,000 miles were built it would add $175,000,000 to the taxable wealth of the state. Something has cost Oklahoma this taxable property. It is up to the people of the state to look for the reason. Something is wrong somewhere. Capitalists say that their funds can be invested with a feeling of safety only where the laws of a state are settled upon a fair and conservative basis, and when there is reason to believe there is no danger of people being prejudiced against investments by the invective of demagogues. If the spirit of Oklahoma is being misrepresented by a few self-seeking politicians, the people ought to know it and apply the remedy without delay.

Before Judges Grosscup, Baker and Seaman at Chicago Nov. 12 the Wabash and other roads, which have recently been fined by the federal courts for violations of the safety appliance law, presented arguments on appeal from the judgment of the courts in which the cases were originally heard. The contention of the railroads is that the commission has no power to order safety appliances upon engines and certain vehicles which are not used in interstate traffic. Some of the railroads believe that the commission is unfair in its enforcement of the law. The inspectors of the commission are nearly all former railroad employees who are members of the various labor unions, and it is charged that they are purposely hunting up merely technical violations of the law. Up to the present time, it has been the custom of the railroads to plead guilty when the violations have been technical and throw themselves upon the mercy of the court. But the courts apparently have no discretion in the matter and the railroads are disposed to resist the exercise of such extensive power by the commission.

The Northern Pacific's Land and Improvement Company.

The New York *Sun* publishes the following: The Northwestern Improvement Company, the most important subsidiary corporation of the Northern Pacific, owns property, chiefly in Washington and Montana, valued at fully $50,000,000. From the earnings and profits of the so-called concealed assets the Northern Pacific is paying the extra dividend of $17,000,000 which was announced a few days ago.

The company was organized by Daniel Lamont soon after he became vice-president of the Northern Pacific. It is a holding company, its primary purpose being to acquire, hold and sell all Northern Pacific properties not used in its actual transportation business. It has been considered desirable that these properties should not pass under the Northern Pacific general mortgage, thus entailing much red tape when sales were made. The properties owned by the Northwestern Improvement Co. include the following:

The Roslyn, Cleelum, Melmont and Ravensdale coal mines, composing the most important group of coal mines in Washington; vast valuable and chiefly undeveloped coal lands at Tenino, Renton, Black Diamond and Wilkeson, with others in Cowlitz and Kittitas counties, Washington; the Rockfork and Cook City coal mines, among the largest in Montana; several thousand acress of undeveloped coal lands at Bull Mountain,

Mont., north of Billings, near the line of the Chicago, Milwaukee & St. Paul's Pacific coast extension; tide lands and waterfront property at Tacoma, Wash., valued at several millions, and also many lots on Pacific avenue and other business streets in Tacoma, and the greater part of old grade between Columbia river and Tacoma built by the Union Pacific under President Sidney Dillon in 1892.

After the Union Pacific became bankrupt, Mr. Hill caused this grade to be purchased at a tax sale. Two years ago, when Harriman was fighting Hill's Northbank Railroad, this old grade was used as a club to keep Harriman from gaining quick entrance to Puget Sound from Portland. Vice-President Levy, of the Northern Pacific, announced at that time that the Northern Pacific would at once build an electric line between Tacoma and Portland, using the old grade.

Soon afterward Hill and Harriman settled their differences in Washington and Oregon, exchanging rights of way where needed. The Northern Pacific has sold since to Harriman more than sixty pieces of property at Tacoma, Seattle and along Harriman's right of way to the Columbia river. Nearly every one was deeded by the Northwestern Improvement Co., the deeds having passed within the last thirty days. Several pieces were parts of this old grade, but for the most part Harriman's new route is different.

Harriman money from three sources has contributed to the $17,000,000 dividend declared by Northern Pacific, as follows: Rights of way between Tacoma and Portland, rights of way across Tacoma tide lands and elsewhere in city, money paid by the Oregon Railway & Navigation Co. for Roslyn coal used by it in eastern Washington.

Through the holdings of the Northwestern Improvement Co. Mr. Hill has partially duplicated the profits made by Harriman from Hill stocks received upon the dissolution of the Northern Securities Co. Future profits of the Northwestern Improvement should far exceed those now distributed. President Elliott, of the Northern Pacific, is president of the company.

America at the Earl's Court Exhibition.

The Rock Island-Frisco system is making a special effort to interest the people and public officials along its lines in the Earl's Court Exhibition in England next year, with a view to having the Southwest well represented. The Earl's Court Exhibition, which is an annual event in London, will be devoted next year to the "Golden West and American Industries." A. Jackson, General European Agent of the Rock Island-Frisco system, with office at London, called attention to the matter, and Passenger Traffic Manager Sebastian has written about it to the governors of the states in his territory, and also to the newspapers. The responses indicate that much interest in the project is being awakened. He has also issued a circular telling something of this notable British institution. The buildings and grounds cover more than 22 acres. No representative exposition of American products and manufactures has been held in Great Britain in 20 years, and a well directed effort to present the development and achievements of the United States is now fitting.

Twenty Killed in Two Collisions.

In a rear collision of southbound passenger trains on the New Orleans & North-Eastern at Little Woods, La., November 11, eleven passengers were killed and 20 or more were injured. The wreck took fire, but it does not appear that any of the injured persons were burned. The leading train was standing at the station, being somewhat behind time. There was considerable fog. The following train was one of the New Orleans Great Northern, which company uses the track of the New Orleans & North-Eastern from Slidell to New Orleans. This train was running so fast when it struck the other that the engine completed crushed the rear car of the North-Eastern train. The victims were all passengers in the leading train.

In a rear collision of freight trains on the Union Pacific, on the night of November 11, at Borie, Wyo., nine men were killed. One of the trains had become uncontrollable while descending a steep grade. The wreck took fire and burned furiously for several hours, cremating the bodies of part of the victims. The men killed were the conductor, enginemen, fireman, three brakemen and five Japanese laborers.

Louisiana Railroads Fined for Collision.

The Railroad Commission of Louisiana has ordered the Louisiana Railway & Navigation Company and the Yazoo & Mississippi Valley each to pay into the state treasury a fine of $5,000 for alleged negligence that caused a fatal collision at a grade crossing on June 20 last. One passenger was killed and about 20 persons were injured. The evidence showed that a freight train on the L. R. & N. and a passenger train on the Baton Rouge, Hammond & Eastern branch of the Yazoo & Mississippi Valley collided at the crossing of the two lines. The passenger train did not come to a stop or send forward a brakeman, as required by a rule of the state commission. It was also shown that the L. R. & N. had no signal at the approach to the crossing except a stop board only 200 ft. from the crossing. After a hearing the commission ordered the companies to show cause why interlocking signals should not be installed at this crossing, but has withdrawn this order for the purpose of allowing further investigation. The commission in making its order in the case said: "Too much human life has been sacrificed by the carelessness of employees. The record of deaths from railroad accidents in the United States has become the subject for national alarm, and when the direct evidence in an accident case shows that the accident was the result of the reckless disregard of the safety of others, this commission feels that it is its duty, under the law, to inflict the severest penalty in its power. The mere fact that the damage claims have been paid promptly has nothing to do with the case. The commission's rules must be obeyed and its orders carried out. Corporations must understand that a lax system of enforcing the rules of the commission among employees will be promptly met by the commission with just punishment, and when rules and regulations are made by the commission for the protection of human life, and their reckless and wilful violation results in the death and injuring of passengers, the power of the commission will be exerted to its utmost strength to prevent such occurrences in the future and to impose such penalty as will impress upon all interested the importance of obeying orders."

Pointers for Train Despatchers.

Don't try to send 47 words a minute to an operator whose capacity is 47 words an hour.

* * * It is called the double order system because the orders these days usually have to be sent at least twice.

Don't cuss the conductor. There are 20 or 30 conductors to one train despatcher, so the feat of even catching up is hopeless.

Some of the most phenomenal runs are made by certain enginemen before they start out. If you wish to be "in" with the denizen of the box seat make him good natured by constantly referring, while in his presence, to the fast time he made the day he had the "caboose bounce." It requires only a slight knowledge of the classic art of prevarication to raise the tonnage from nil to "rating and a half." Every engineman I ever knew made a good run at some stage of his career if it was only getting from the platform to the despatchers' office to prove that the other fellow caused the delay you were trying to avoid.

Be sociable with the Maintenance of Way officials and they will do some of the most remarkable stunts in saving track and preventing washouts (especially in dry weather) that you ever heard of. A long suit of this class of effervescence is particularly entertaining if you have on your hands four excursion trains and two wrecks.

When the "lady" operator of Kokomokomo breaks into the middle of an order and whispers "H. Q. B." don't give way to feelings of violence. She means "S. F. B." and even "lady" operators have to "feed."

Don't put all the movements into one order because, sooner or later, there will come to see you a train despatcher with a story about where he works; where the train sheet reaches across the street and where 94 orders is the customary allot-

ment on an eight-hour trick. This imaginative liar is less numerous than formerly but if you fix up all your trains with one grand outburst of train order enthusiasm when you "set in" you will be more likely to disbelieve your loquacious visitor.

Note.—It is possible to send 94 orders on an eight-hour trick—by mail.

If you happen to be a poor despatcher be sure to smile when the superintendent says it was a bad deal the purple flyer got on your trick three weeks ago next Tuesday. Assure him you have not slept for worrying since it occurred. His heart will kind of warm up to you if you look penitential. If you are a good despatcher don't tell him to go to the devil—jobs are reasonably scarce.

Don't grog up. There's nothing to it.

Don't harass operators—or others.

A poor operator, as a rule, will sing your charms far and near if you give him a show. It takes poor operators to make good ones.

Be resourceful. I once heard of a despatcher whose division was hopelessly blocked with snow and the only available engine was off the track. He sent a derrick on bob-sleds drawn by oxen to the relief of the helpless engine. The road was narrow gage and small, but the despatcher was on the job.

If the laws were faultless all the lawyers would starve. By the same reasoning, if the time-tables all were flawless the train despatchers might suffer the pangs of hunger.

The best way to get on with the trainmaster is to make him think you think he ought to be in charge of the whole division in order to make things go as they ought. (All trainmasters are not like this; only the majority of them.)

Don't turn over to your relief a sloppy transfer. Fix up the trains so they will run at least until he can read the transfer and take a chew.

Adhere strictly to the rules and bulletin instructions. (If you wish to be put out of the business permanently.)—*Train Despatchers' Bulletin.*

Ignorance in Boston!

The child in city slums who never saw a cow has become a fixture in our literature, and excites no comment; but now another painful scene has been enacted—and in the most progressive city in the world. Here it is:

Boston, Nov. 7.—The last of Boston's horse cars, which were retired from use 10 years ago, started from the Lenox street barns this morning for its last journey in this city. Two horses towed the car as in former days, a spectacle which created much comment. This car and 16 others have been sold for service in New York City, where they will be used on the east side. Children on the streets ran after the car, begging a ride, as many of them had never seen a horse car.

Indiana Convention on Railroad Accidents.

The first Indiana state convention on railroad accidents was held at Indianapolis on November 10. Such conventions were provided for by a law passed by the Indiana legislature in 1907. The Railroad Commission invited to this convention division superintendents and other operating officers of railroads in the state, and also trainmen, not more than two trainmen for each 200 miles of line. Over 100 railroad officers and employees attended the convention.

Union B. Hunt, Chairman of the Commission, presided. Commissioner W. J. Wood made an address reviewing the efforts of the Commission to reduce accidents. For accidents to trespassers railroads are not responsible, and the Commission will recommend legislation to forbid the use of railroads as highways. For accidents at highway crossings the remedy is to separate grades, and the Commission will recommend the prohibition of the construction of any more railroad grade crossings and action looking to division of expense of separation of grades and elevation of tracks between the public and the roads so that existing grade crossings may be abolished. The speaker referred to a statement made by James A. Fagan to the effect that investigations of railroad accidents have been avoided "because no man can apply a probe to a serious railroad accident without running the risk of a clash with a labor organization." Commissioner Wood said:

"Gentlemen, this is a most serious charge; namely, that railroad men, managers and commissioners are afraid to investigate accidents and find out and publish the truth with regard to them because of labor organizations. While I will not concede that such a condition exists, I can affirm, without being a prophet, that if it does exist it will be changed and corrected."

The commission believed it best, said Mr. Wood, to cultivate the most cordial relations between the commission and the officers and men of the railroads. The commission had found the officers of the railroads willing to co-operate. No sensible person supposes that the railroad officers do not above all things desire the safety of the men who work for them.

A committee of seven was appointed to study the causes of accidents and suggest remedies. The committee is composed of the following: J. C. Hagerty, Superintendent, Baltimore & Ohio Southwestern; J. W. Coneys, Superintendent, Pittsburgh, Cincinnati, Chicago & St. Louis; F. H. Wilson, Superperintendent, Lake Shore & Michigan Southern; Alexander Shane, Chief Inspector for the Indiana Railroad Commission; F. E. King, Locomotive Engineer, Wabash; Theodore Laughlin, conductor, Southern Railway; F. L. Howard, conductor, Chicago, Indiana & Southern.

The convention was addressed by Captain Azel Ames, of the Interstate Commerce Commission, and Col. B. W. Dunn, of the Government Bureau for the Safe Transportation of Explosives. Captain Ames said that the man was the most important factor in railroad accidents, and that 75 or 80 per cent. of the accidents on railroads are due to violation of rules. The superior who saw an employee violate a rule without "calling him down," even though no accident resulted, was guilty as well as the employee. In many cases the railroads would get better results in the prevention of accidents by spending more money on men rather than on safety devices.

Intolerable Labor Conditions In San Francisco.

In an address at San Francisco November 12 Charles M. Schwab, head of the Bethlehem Steel Corporation, told his hearers that "never again will any sane, conservative business man build a ship here until the labor situation has materially changed. Until this is brought about you can accomplish nothing in the way of construction or manufacture. The cost of labor in this city is twice as much as in any of the Eastern cities—not so much because of the wage paid, but because of the amount and quality of the work performed. I lost $3,000,000 here in one year because of the attitude of union labor, and scratched it off my books as charged. It may take a long time to realize it, but the awakening must come. Only concerted action by all the merchants involved, persistent and unremitting, will relieve the situation. Until that is done San Francisco will not assume the position that is rightfully hers in the commercial world. And when it is done I shall be willing to risk my dollars here, with many other Eastern capitalists."

A Monorail in New York.

The New York State Public Service Commission, First District, has given its consent to the construction of a "monorail" line for carrying passengers between Bartow Station, on the New Haven & Hartford Railroad, to City Island, both termini in New York city. The length is 3½ miles. The route is now served by horse-car lines. The application was made by the American Monorail Company. Commissioner Eustis has been conducting hearings for several weeks upon the application of the company, of which the president is Bion L. Burrows, who was secretary to the former New York Rapid Transit Commission.

George S. Rice, one of the engineers of the Commission, made a report on the monorail after an examination of an experimental railroad operated last year at the Jamestown Exposition. Mr. Rice, in his report, said: "I find it a practicable system which will lend itself easily to the transportation of

passengers with safety and economy. I have no doubt that on a roadway constructed with that care and thoroughness which would be devoted to a permanent railroad, the monorail car would be able to attain a high rate of speed with safety and economical use of power and with a moderate expenditure for maintenance."

The resolution adopted by the Commission refers to the system as having been perfected by Howard Hanson Tunis.

Mr. Burrows says that he is ready to proceed to construction forthwith; but he must first go to the president of the Bronx and to the park commissioner in the Bronx for approval. The Monorail company now controls the stock of the two horse-car lines, which were formerly owned by the Interborough Rapid Transit Company.

State Regulation in New York.*

The commission thus far, in its search for the ultimate truth, has been fortunate in having the support of both those of socialistic tendencies, who favor government ownership, and those who believe strongly in the right of private property, for it represents both. Most people hardly realize the great change that has come in our conception of the field of operation of the public-service corporations.

All public-service corporations start, not as monopolies, but as competitors of existing service. In the beginning the railroad started as the competitor of the Erie canal and the highways. The new thing was first a convenience, then a necessity, and when it became a necessity the company furnishing that necessity became a monopoly. The English race is not fond of monopoly; we have tried to break up the monopoly by granting additional franchises, but that plan has failed. So the sooner that we recognize that the public-service corporations are monopolies, the sooner shall we be able to tackle the problem intelligently.

New York suffered through its failure to recognize this fact. Massachusetts has for years had the best of railroad commissions. In New York the commission was a failure. Two years ago matters were so bad that we seemed to be on the verge of revolution; but the revolutionists, the Hearst party, did not win, and Hughes did. Mr. Hughes sized up the situation and as a remedy he advanced the public service commission bill. By arousing public opinion, pressure was brought to bear by the people, and the bill was passed. There is, of course, some question of the advisability of commission government. I favor it when a judicial determination is concerned, but not for administrative or executive purposes. The public service commission is a special court. Its work has been criticized. Its personnel, the law, and its work may be improved; but some of the problems are almost insoluble, and in many cases the innocent must suffer for the wrongs of the guilty. The moment you have a great corporation, with watered stock in the hands of many innocent investors, the public will suffer if dividends are paid, and the investors will suffer if the public gets good service at a reasonable rate. Those who engineer the scheme escape. * * * The commission cannot authorize the capitalization of franchises. This fact recognizes that the great corporations are not private businesses. The land, streets, etc., do not belong to the companies, and cannot be capitalized. This is a radical departure. The whole bill, in fact, is not only radical but revolutionary. * * *

There are therefore three ways of handling the question before us: (1) By government ownership; (2) by letting things go on as they have before; (3) by regulation. The last election shows that New York is against the old way, and we are not yet ready for government ownership. The third is the only one left. It is still an experiment. It has been charged that the up-state commission has done no work. In the 15 months of its existence it has handled and disposed of 1,695 cases, an average of 4½ a day, of wide variety, some of them trivial. Twenty new corporations have been authorized—three railroads and 17 gas and electric companies. It has authorized the issuance of $106,000,000 in securities. As a result of its work we have seen the practical abolition of rate discrimination, tariffs are now filed and rebates are practically abolished, thanks chiefly to uniform accounting. We have a greater movement of freight, especially in the yards, and the rates on freight have been reduced all along the line. Train delays have been done away with to a large extent; the commission has insisted that the trains run on schedule or that the schedule be changed.

Before the birth of the commission, any one with a complaint went with it to a subordinate railroad officer, and was, of course, turned down. Subordinates have a habit of turning down complaints of little things. But now they come to the commission, and the commission, in dealing with the men at the top, has found them ever ready to give way in little things. These are usually for the betterment of the service. Also many complaints never reach the commission, for the companies are beginning to realize that it is better to give way in the smaller things, which are generally just, than to bother to come before the commission. The law also gives the commission the ability to cause returns to be made quickly. For instance, in case of an overcharge, if the commission decides that an overcharge has been made, an order is issued to have it paid, and it must be paid.

There is little doubt that the public service commission has satisfied the public needs of the present. We are moving in the right direction, but some of the most difficult problems are not yet tried out. The commission has seen that the corporations act justly by the public, and the public by the corporations. It is a court of justice, although the corporations are just beginning to realize this fact. They do not yet see that they are not running a private business.

* From an address by Thomas M. Osborne, of Auburn, member of the New York Public Service Commission, Second District.

Pullman Company Annual Report.

The annual statement of the Pullman Company shows a total revenue of $31,620,241, with total operating expenses of $18,001,759. There were dividends declared amounting to $7,998,356, and this, together with depreciation and net earnings paid to associated interests, left a net surplus of $1,790,568. The company has a capital stock of $100,000,000. Cars, real estate and operating supplies are valued at $70,257,773, and cash investments and sundry accounts receivable bring its total assets up to $116,173,340.

In a supplement to the annual statement, Robert T. Lincoln, President, says that the value of the manufactured product of the manufacturing department for the year, and rental, together aggregate $24,868,653, against $37,236,417 in the previous year. Building of cars for sale almost completely ceased during the last half of the fiscal year.

The total mileage of railroads covered by contracts for operation of the company's cars was 198,610. The number of passengers using Pullman cars during the year amounted to 18,603,067, and the total car mileage was 497,708,660. This is an increase of 3 per cent. in the number of passengers and a decrease of about 3,730,000 in the number of miles run, or less than 1 per cent.

Life in London.

The audience in the Guildhall court yesterday laughed irrepressibly during a case in which Arthur Cockburn Marriott, an elderly gentleman, summoned Stanley Thomas, a booking clerk at the postoffice tube station, for having used offensive language to him. "I went to the tube station," said the complainant, "and I said very politely to the booking clerk, 'Can you give me a ticket?' He said rudely and curtly, 'Where for?' (Laughter.) Perfectly calmly I replied, 'When you are asked a civil question cannot you say "Yes" or "No"?' He said, 'Why, you silly old ass, can't you say where you want to go?' (Loud laughter.) Again perfectly calmly—(laughter)—I replied, 'I really think that will get you into trouble,' and I took an exact note of his words. (Laughter.) I put down my money, and said, 'Will you give me a ticket for Holland Park, please?' The ticket was thrown at me with the following words, 'If you'd be civil to me I'd be civil to you, but I won't stand insolence from anybody.' I replied, perfectly calmly—(laughter)—'I think this will get you into very serious trouble.' To which he replied, 'Why, I'll come out and pull your nose for you.' (Loud laughter.) To which I replied,

'Ah! will you? Then you'd better come and do it.'" (Laughter.) No pulling of noses took place, however. The summons was dismissed.—*Westminster Gazette.*

Passes Good for Life.

The Supreme Court of the United States on Nov. 16 dismissed the Louisville & Nashville suit brought to test the validity of the anti-free-pass section of the Interstate Commerce law, for want of jurisdiction. As compensation for injuries received some years ago by Erasmus Mottley and his wife, the company gave them free passes over its road during their lives. When the law was modified in 1906 the passes were withheld on the ground that their issue would be in violation of law. The Mottleys brought suit to compel the issue, and the federal court in Kentucky held that the law did not apply to such passes, and ordered their issue. The railroad appealed.

New York Barge Canal Contracts.

At Albany, November 17, bids for two large canal contracts aggregating nearly $4,000,000 were opened at the office of the State Superintendent of Public Works. Contract No. 40 calls for the improvement of the Erie Canal from Lockport to Sulphur Springs Guard Lock, a distance of about five miles. The engineers have estimated that this work will cost $2,516,743. Contract No. 46 calls for the construction of the canal from Fox Ridge, Cayuga county, to the southeast corner of the town of Galen, a distance of about ten miles. The cost of this work is estimated at $1,367,583. Five bids were received on contract 40, that submitted by the United Engineering & Contracting Co., New York, for $2,166,298, being the lowest. The bid was about $350,000 under the engineer's estimate. Of the seven bids submitted for contract 46, that of the Kinser Construction Co., of Chicago and Fort Edward, N. Y., for $1,212,833, was the lowest, being $154,750 under the engineer's estimate, making the total of the low bids on the two contracts about $500,000 less than the estimates prepared by the engineers.

South Manchuria Railway.

The following information relative to the operation of the South Manchuria Railway during the year ended March 31, 1908, is reported by Consul Roger S. Greene, of Dalny:

Since the company was still working almost entirely with the old narrow-gage rolling stock, which it has now replaced with new standard-gage equipment, and its energies were largely absorbed in preparations for the change, the past year cannot be taken as an accurate index of the degree of financial success which the company is likely to attain in the future. On account of the lack of rolling stock the coal business has been very little developed, and for this reason also the profits are smaller than they otherwise would be.

The total receipts for the year ended March 31, 1908, from all branches of the company's activity were $6,246,472, and the expenses, including interest on bonds and payment to a fund to meet the difference between their par value and the net proceeds, amounted to $5,242,212. Adding to the receipts the balance from the first half-yearly period (before the road was taken over), namely, $191,103, and subtracting the expenses, we have a balance of $1,195,362. Out of that sum a 6 per cent. dividend was paid and a balance of $798,043 carried forward to next account. If this balance had been divided among the shares held by the government it would have amounted to a dividend of 1.6 per cent., and it therefore appears that though the railroad is not yet bringing in a large profit to the Japanese government it is at least able to pay all its expenses with a fair margin to spare.

The only departments, except the railroad proper, to show profit during the year were the mines and the harbor, the excess of income over expenses for the coal business being $275,396, and for the harbor, $6,146. As the harbor, electric plant, and hotels are distinctly tributary to the railroad, they are undoubtedly of advantage, even when, considered separately, they are operated at a loss.

The company's report gives the sums spent for capital account on the several departments during the past year, amounting in all to $6,996,281. As the company received a practically dismantled road, a certain amount of reconstruction and repair necessary to put it on a proper basis to start with appears to have been charged to capital account instead of maintenance. A great deal still remains to be done. The new rolling stock is not yet all set up, the work on the double track from Dalny to Suchiatun will scarcely be finished before the beginning of next year, the harbor works are only begun, and even the plans for the reconstruction of the Antung-Mukden line have not yet been definitely adopted. However, once the rolling stock is all in running order, the early completion of the remaining enterprises cannot be considered a matter of urgent necessity from a business point of view, since a single-track standard-gage line, with the present harbor facilities, should be able to handle satisfactorily an even greater volume of business than can reasonably be anticipated in the near future.

A full report of the proceedings of the third semi-annual meeting of the South Manchuria Railway Co., transmitted by Consul Greene, is on file in the Bureau of Manufactures, Washington, D. C.

Railroad Extensions in Uruguay.

Consul F. W. Goding sends from Montevideo the following information of new railroad lines planned in Uruguay:

The Uruguay East Coast Railway Co. (Limited) was registered in London on July 14, with capital £125,000 ($608,313). The objects are to acquire from the government of Uruguay a concession for operating an existing line from Olmos Junction to La Sierra, and for constructing, equipping and operating extensions thereof from La Sierra to Maldonado, Rocha, and elsewhere, and to adopt an agreement with the Uruguay Great Eastern Railway Co. (Limited). The directors shall create a series of 5 per cent. first charge debentures, not exceeding, in the first instance, £315,000 ($1,532,947) in nominal value, which limit may be increased by £5,000 ($24,332) for every kilometer (0.62 mile) of railroad hereafter constructed in excess of 63 kilometers (39.15 miles), and shall also create £184,980 ($900,205) income debenture stock, with interest at 4 per cent., payable during the first three years from issue only out of the net revenue of the company.

Application for a concession has been made for the construction of a new line to extend from Tres Arboles station, on the Midland Railway, to Piedra Sola. The line will be standard gage, the length about 50 kilometers (31.07 miles). The usual conditions of the Railroad Act, including a 3½ per cent. guaranty, will apply, and it is understood that the line will be completed within three years.

Russian Railroad Earnings.

Consul James W. Ragsdale, of St. Petersburg, supplies the following statistics concerning the revenues and expenditures of the Russian state railroads:

According to data just published by the state control, the net revenues of state railroads have decreased in 1907 by $6,932,500, notwithstanding that the gross receipts increased by $41,200,000. This gain has been engulfed by the increase in operating expenses, amounting to $48,132,500 as compared with the preceding year. The roads giving the best profits are: Baskunchan, Ekaterininsky, Libau-Romny, Moscow-Kursk, Riga-Orel, Syzran-Viazma, Harkov-Moscow, Ussuri and Southwestern. The Moscow railroad ceased to give net profits on the annexation of the Vologda and Volkovysk lines. The railroads showing the greatest losses are the Transbaikal, Siberian, Samara-Zlatoust and Tashkent. The losses on these lines are caused partly by the very low tariff for emigrants, transported in great numbers.

New Railroad in Ecuador.

Consul-General Herman R. Dietrich, of Guayaquil, has reported as follows concerning the building of a new railroad in Ecuador:

The line starts at Huigra, 72 miles from Guayaquil, at an elevation of 4,000 ft. above sea level, thence to Cuenca, lo-

cated at an elevation of 8,500 ft., crossing the Azuay range by a valley along the river Augas and passing through a well-populated district. The distance from Huigra to Cuenca is 92 miles. The contractors with the government to build the road are an American and an Englishman. The general direction of the road is from north to south, and at a distance of 31 miles from Huigra it intersects the intercontinental survey, following the same, with some slight changes, to Cuenca. At Biblian, 71 miles from Huigra, the road will pass through a district said to contain great quantities of coal, which it is reported has been thoroughly examined by competent mining engineers, who reported the coal as being in enormous quantity and of good quality.

In 1906 an arrangement was made between the owners of said lands and a contractor whereby they agreed to accept 25 per cent. of the stock in a coal company to be formed for all their rights and titles to the lands, so that the railroad company could own and control the entire output of coal subject to the building of a line from Huigra to Cuenca, passing through the lands. The maximum grade to be built is 3½ per cent., and the road will run through six miles and more of forest, said to contain a good quality of timber, which the promoters expect to use for ties and for timbering the coal mines.

It is expected that this line will in time prove to be very important, as aside from being one of the links of the Intercontinental Railway, it opens up the vast southern plateau of Ecuador and places the city of Cuenca (the third city of Ecuador) in railroad communication with Quito and Guayaquil. At present all coal used in Ecuador is imported at high prices, but this home coal can, by means of the Guayaquil & Quito Railway later on, be delivered to the interior towns as well as at the port of Guayaquil at a moderate price.

American Society of Civil Engineers.

At the meeting held in New York on Wednesday, November 18, 1908, a paper by T. Kennard Thomson, M. Am. Soc. C. E., entitled "Foundations for the New Singer Building, New York City," illustrated with lantern slides, was presented for discussion. This paper was printed in "Proceedings" for October, 1908.

American Railway Engineering & Maintenance of Way Association.

William McNab, Principal Assistant Engineer of the Grand Trunk, heretofore First Vice-President of the Maintenance of Way Association, has been elected President, succeeding the late Walter G. Berg. L. C. Fritch, of the Illinois Central, who has been Second Vice-President, becomes Vice-President, there now being but one.

Southwestern Traveling Freight Agents' Association.

The Southwestern Traveling Freight Agents' Association has elected the following officers: President, F. R. Kretschmar, St. Louis Southwestern; Vice-President, F. P. Zimmerman, Cleveland, Cincinnati, Chicago & St. Louis; Secretary-Treasurer, G. W. Boogher, Chicago & North-Western; Executive Committee, G. W. Bandon, Pennsylvania Lines; E. B. Wood, Cincinnati, Hamilton & Dayton and Pere Marquette.

Roadmasters' & Maintenance of Way Association.

The following officers have been elected for the ensuing year: President, A. E. Hanson, Chicago & North-Western; Vice-President, James Sweeney, Chicago & Eastern Illinois; Second Vice-President, W. A. Brandt, Chicago & North-Western; Secretary and Treasurer, Walter E. Emery, Peoria & Pekin Union (re-elected); Member Executive Committee, W. H. Köfehl.

The Roadmasters' Association of the Chicago, Milwaukee & St. Paul, in session at the same time, elected these officers: President, William Shea, Lakeburg, Ia.; Secretary and Treasurer, M. Murphy, Sioux City, Ia.

Western Railway Club.

At the regular monthly meeting of the Western Railway Club at the Auditorium Hotel, Chicago, on the evening of November 17, Prof. Charles H. Benjamin, Dean of the School of Engineering, and Director of the Engineering Laboratory at Purdue University, Lafayette, Ind., presented a paper on "Flat Spots on Car Wheels." After the discussion of this paper, George A. Post, President of the Standard Coupler Company, and also President of the Railway Business Association, spoke on "Railroads and the Business Revival."

Canadian Society of Civil Engineers.

A meeting of the general section was held on Thursday, November 19, at Montreal, Que. There was a discussion on Prof. Brown's paper, "Tests of Reinforced Concrete Beams." The following papers were presented: "Notes on Canadian Forestry," by S. Gagné; "Mean Sea Level at Quebec and New York," by W. Bell Dawson.

A meeting of the mining section was held on Thursday evening, November 12. A paper on "Modern Retort Coke Ovens, with special reference to the Practice of the N. S. Steel & Coal Co.," by C. L. Cantley, was read and illustrated with lantern slides.

New York and New England Railway Surgeons.

The eighteenth annual meeting of the New York and New England Association of Railway Surgeons was held in New York, Nov. 17. Dr. R. W. Corwin, division surgeon on the Missouri Pacific, read a paper on "Negligence of the Employee from Disease and Overwork." He told of a case where jealousy of a young engineer caused another to neglect his work. Another who backed his train into an excursion train was worrying over losses in gambling. Dr. Corwin denied that railroads overworked their men by deliberate choice; it would not be profitable. Sometimes drink is mistaken for brain-fag and overwork. The public has a right to demand from the railroads that employees have sufficient rest, but that does not go far enough. The employees should take rest during the time allotted to them, but when they do not do so, what then? The employee has no more right to return to work when he is tired than would the railroad have the right to make him work when tired. The employee who uses his hours of recreation for gambling, drinking, and smoking to excess is no more fit for work than is the man who has been on duty eighteen to twenty hours. He said he was told that the greatest trouble the manager of a large railroad has is to provide counter attractions to the saloon and gambling halls.

J. O. Fagan read a paper on "Neglect of Employees to Observe Signals and Obey Rules," and was applauded by the physicians. Improvements in automatic safety devices and signals, Mr. Fagan held, caused employees to cease to feel personal responsibility in their duties in many cases of accidents. He advised more systematic education of employees in the line of their work, and suggested that the manager should take employees into their confidence as to the obligations of the roads, both to the public and stockholders.

Officers were elected for the ensuing year as follows: President, Dr. J. M. Wainwright, Scranton, Pa.; Vice-Presidents, Dr. C. A. Pease, Burlington, Vt., and Dr. G. C. Madill, Ogdensburg, N. Y.; Corresponding Secretary, Dr. George Chaffee, Brooklyn; Recording Secretary, Dr. C. B. Herrick, Troy, N. Y.; Treasurer, Dr. J. K. Stockwell, Oswego, N. Y.

American Railway Association.

The fall meeting of the American Railway Association was held at the Auditorium Hotel, Chicago, on Wednesday of this week. About 80 members were represented by 250 delegates. The association now has 341 members, operating 244,258 miles of road, and 60 associate members, operating 2,289 miles.

The executive committee reported that the commission, headed by James McCrea, on the interchange rate for freight cars was not ready to report.

A resolution was passed, at the suggestion of the car serv-

ice committee, that railroads be requested to furnish to the *Railway Equipment Register* information respecting car equipment, line clearances and restrictions of cars in passenger service. The committee on the proposed reorganization of the Association made a report embodying suggestions in line with the propositions presented in April, but it was referred to the Executive Committee to be brought up again at the May meeting.

A resolution was adopted requesting the Master Car Builders' Association to formulate a rule for standard marking of flat cars; the length to be taken from end to end of sills, and drop end cars to be stenciled with inside length as well as the total length.

The report of the committee on safety appliances showed 2,184,343 freight cars, of which 97.5 per cent. are equipped with airbrakes.

The joint committee on interlocking and block signaling recommended, and the Association adopted, a resolution that "in the opinion of the American Railway Association the substitution of the telephone for the telegraph in blocking and despatching trains can be made safely; and the use of the telephone for such purposes is recognized and recommended as a standard operating instrumentality."

Wednesday being the 25th anniversary of the adoption of standard time, a resolution, offered by G. L. Peck, of the Pennsylvania Lines West of Pittsburgh, was adopted congratulating Secretary W. F. Allen on the success of his labors for its adoption.

Daniel Willard (C., B. & Q.) was re-elected Second Vice-President.

New York was chosen as the place for the May meeting.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries and dates of next or regular meetings.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State street, Boston, Mass.; June, 1909.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th street, New York; second Friday in month.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M. R.R., Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, 962 Monadnock Building, Chicago; March 16-18, 1909.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, 390 Old Colony Building, Chicago; June, 1909.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th-street, New York; 1st & 3d Wed. in month, except July and Aug.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 West 39th street, New York; December 1 to 4, 1908.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 West 39th street, New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn street, Chicago, last Wed. in April, 1909.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—C. L. Young, C. & N.-W. Ry., Chicago, Ill.; May, 1909.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wis. Central Ry., Chicago; June 23-25, 1909.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park place, New York; December 8, 9, 1908.

CANADIAN RAILWAY CLUB.—Jas. Powell, Grand Trunk Ry., Montreal, Que.; first Tuesday in month, except June, July and August.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; January.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty street, New York; second Friday, in January, March, May, Sept. and Nov.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 62 Liberty street, New York; May, 1909.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Iowa; second Friday in month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Building, Chicago, Ill.; June, 1909.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver street, Boston, Mass.; 2d Tues. in month, except June, July, Aug. and Sept.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty street, New York; third Friday in month, except June, July and August.

NORTH-WEST RAILWAY CLUB.—T. W. Flannagan, Soo Line, Minneapolis, Minn.; 1st Tues. after 2d Mon. in month, except June, July, Aug.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; fourth Friday in month, except June, July and August.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden street, Bethlehem, Pa.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; second Friday in month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, 218 Prudential Bldg., Atlanta, Ga.; 3d Thurs. in Jan., April, Aug. and Nov.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.

WESTERN RAILWAY CLUB.—J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.; 3d Tuesday each month, except June, July and Aug.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Building, Chicago; first Wednesday, except July and August.

Traffic News.

At New Orleans, November 14, the United States Circuit Court of Appeals decided in favor of the Pullman Company in its suit resisting an order which had been issued by the Texas State Railroad Commission, reducing parlor car and sleeping car rates in that state 20 per cent.

The State Railroad Commission of Alabama, acting in behalf of complainants in Union Springs, has complained to the Interstate Commerce Commission against cotton rates on the Central of Georgia; and it is requested that all of the railroads in the state, doing interstate business, be made defendants.

In the Federal court at New Orleans, November 11, the Texas & Pacific was indicted for illegally collecting demurrage charges on cars of grain. It is charged that bills were presented and collected for delays of cars which the company knew at the time had not arrived at New Orleans and could not possibly be delivered.

The Executive Committee of the National Industrial Traffic League, at a meeting in Chicago on November 12, decided to canvass carefully the objections made by shippers to the uniform bill of lading and then ask for a conference with representatives of the railroads. The conference will not be asked until after the January meeting of the League.

The Commercial Exchange of Philadelphia has filed a complaint with the Interstate Commerce Commission against the Pennsylvania, the Philadelphia & Reading and the Baltimore & Ohio alleging discrimination against Philadelphia flour merchants. New York merchants are allowed 13 days free storage on shipments of flour but Philadelphia merchants are allowed four days only, giving New York a decided advantage as a distributing point.

The Arkansas Railroad Commission on November 11 issued an order for state and county officials to proceed against the railroads for collecting the freight rates fixed by themselves instead of accepting from shippers the rates fixed by the Commission. Enforcement of the Commission's rates has been prohibited by the federal court, and any public official disregarding the court's order probably would be called to account for contempt.

The Central Vermont Transportation Company has been organized, in the interest of the Grand Trunk and the Central Vermont, to run freight steamers between New London, Conn., the southern terminus of the Central of Vermont, and New York city; authorized capital, $200,000. The freight steamers now used for this business are owned by the New York, New Haven & Hartford, but the new company will now buy steamships at once, it is said.

The latest novelty in the office of the Indiana State Railroad Commission is a request that the commission make a freight rate for the transportation of water in tank cars. The application comes from coal mining companies, which, on account of the long drought, have exhausted the supplies near their mines and now are obliged to procure water at Terre Haute, Evansville and Vincennes and other places. In some cases water is hauled 50 miles by rail.

It is reported that the railroads in Ohio will on April 1, 1909, discontinue the existing demurrage bureaus in that state, and that each road will handle its own demurrage accounts, subject to a supervising bureau to be appointed jointly by the several roads. There will be a chief supervisor who will appoint assistants to travel over the state and give instructions to agents about car service laws and rules in order that they may be interpreted and applied in the same way. The bureaus are to be discontinued because demurrage is now rigidly regulated by law, making bureau regulation unnecessary.

The United States Circuit Court of Appeals at New Orleans Nov. 14 affirmed the decree of the lower court in the case of the Southern Pacific against the Interstate Commerce Commission in the suit concerning certain alleged discriminatory rates for wharf and terminal privileges at Galveston. E. H. Young, an exporter, of Galveston, was said to be favored by the Southern Pacific and the Galveston Terminal Company,

to the disadvantage of other exporters. It was alleged that, owing to the contract with the railroads and the terminal company, Mr. Young was able to divert to his establishment large shipments of cotton-seed products that would under equitable conditions go to other exporters. The Court of Appeals held that the Commission's order requiring equitable rates to be granted to all exporters should stand.

Commissioner Prouty, of the Interstate Commerce Commission, began taking testimony at Chicago on Nov. 16 in the proceeding brought by commercial bodies at Cincinnati and Chicago to secure reductions in rates on merchandise from central territory to the southeast. H. C. Barlow, Executive Director of the Chicago Association of Commerce; E. E. Williamson, Commissioner of the Cincinnati Receivers & Shippers' Association, and other shippers, sought to show that the existing rates are discriminatory against central manufacturers and jobbers and are the result of unlawful agreements between the roads. Mr. Williamson intimated that the discrimination might be removed by raising rates from Atlantic seaboard points. Arthur Hawxhurst, of Marshall Field & Co., said Chicago jobbers' efforts to get southeastern business had been rendered almost futile for years by unfavorable freight rates.

Judge Niles, of the Federal Court at Jackson, Miss., on Nov. 14, rendered a decision denying the petition of the railroads of Mississippi for a permanent injunction to restrain the State Railroad Commission from enforcing an order reducing rates on cotton from interior Mississippi points to Gulfport, Miss., when such cotton is destined for export. The court had issued a temporary injunction, which was dissolved. The object of the commission's order was to put Gulfport on the same basis as Mobile and New Orleans, as regards rates on export cotton. The railroads contended that the commission's order was discriminatory and would control competitive interstate rates, and was therefore unconstitutional; but the court held that the commission had ample authority to fix the rates and that they did not discriminate against other ports, because Gulfport is nearer to all points in Mississippi than either Mobile or New Orleans. The railroads will appeal to the United States Supreme Court.

Conferences about the action to be taken regarding the decision of the Interstate Commerce Commission forbidding railroads to give allowances to grain elevators were held at Chicago last week by grain dealers of Chicago, Omaha, Buffalo, Louisville and other cities. The decision of the Commission was in the so-called Peavey case. The Union Pacific had a contract with the Peavey Grain Company to give it an allowance of 1¼ cents for elevating its own grain in its own elevators at Missouri river points. In a decision in April, 1907, the Commission ordered this allowance reduced to 7½ mills, and in a still later decision it ordered the Union Pacific to desist from paying any allowance at all, holding that it was in the nature of a rebate. Many owners of large elevators at the large markets claim they are entitled to compensation from the railroads for elevation because they established elevators with the understanding that they would be paid such allowances. The Chicago Board of Trade has refused to act officially in regard to the matter, but a number of large Chicago grain concerns have decided to co-operate with dealers at other points in seeking a reversal of the Commission's ruling. It is understood that the Peavey Grain Company will sue the Union Pacific for the allowance, that the Union Pacific will set up the Commission's ruling and order as a defense, and that thus a test case will be made. The Union Pacific's position was defined in the *Railroad Age Gazette*, July 17, page 544, and August 7, page 687.

STATE COMMISSIONS.

A cinder platform is held by the New York State Public Service Commission, Second district, to be unfit for use at a passenger station.

The Michigan Railroad Commission has ordered every common carrier in the state to post at each of its stations a complete copy of each of its passenger and freight tariffs. Each carrier must cause its traveling auditor or other representative to check up the file of tariffs at each station every six months in order to keep it complete.

The form prescribed by the Interstate Commerce Commission for the filing of reports by express companies has been adopted by the New York State Public Service Commission, and these reports are to be filed in the office of the commission on December 15.

The zone system of passenger fares is held by the New York State Public Service Commission, Second district, to be a proper one to be used on street railways, and in fixing the rates of fare under such a system, mileage is only one factor and not a controlling factor, so that if such zone fares are reasonable in themselves, the fact that the zones are not of equal breadth does not constitute discrimination.

In ordering the improvement of a passenger station which it finds inadequate, the New York State Public Service Commission, Second district, holds that it has the power to require a building which shall present a decent and reputable appearance and in some sort accord with its general surroundings. Old box cars patched on the end of a station building for the purpose of enlarging the freight room should not be approved in a thriving village.

Ohio. Discriminatory Rate on Piling.

J. M. Callahan & Son v. Cleveland, Cincinnati, Chicago & St. Louis.

The complainant alleged that the rates of 8 and 8½ cents per 100 lbs. between certain points on logs to be used as piling were unjust and unreasonable, as compared with the rates of 6 and 6½ cents per 100 lbs. between the same points on logs other than piling.

The defendant said that logs were regarded as a raw material and carriers were afforded additional traffic from the finished product from such logs, whereas piling is a finished product requiring no additional manufacture and affording no additional transportation. Moreover piling is in lengths exceeding the regulation flat car length and requires two cars to accommodate shipments and the risk in the transportation of piling, because of their greater value, is greater than in the transportation of logs.

The Commission found that the differences in the conditions of transportation are not enough to justify differences in rates and held that logs to be used as piling should take the same rates as logs other than piling, when shipped under like circumstances and conditions. The rates on logs other than piling were remunerative and therefore the rates on logs to be used as piling should be reduced to the same basis.

Ohio. Discrimination in Furnishing Cars.

The Carbon Coal Mining Co. v. Marietta, Columbus & Cleveland.

The complainant alleged that the defendant, especially during the months of October and November, 1907, unjustly discriminated against the complainant in the apportionment and distribution of coal cars to the various coal mines on the defendant's lines.

The Commission held that the road had not in good faith made an effort to ascertain the capacity of the complainant's mine and had not apportioned and distributed its available cars fairly. The practice of the defendant in not taking into account railroad fuel cars carded from foreign lines to mines on its lines in apportioning and distributing its available coal car equipment among the operators was held unreasonably discriminatory against operators not receiving any portion of such foreign coal car equipment. The defendant was ordered, when not able to furnish coal cars, to meet the full requirements of operators, to rate the Schuler mine, the Federal mine and the Carbon Coal Company's mine as having equal capacity, and as having each of them one-half of the capacity of the Black Diamond mine, and to distribute cars accordingly.

When fuel cars consigned to a particular mine exceed the percentage allotment of that mine they shall be furnished to the mine to which they are consigned, but that mine shall have no other cars while that situation exists.

REPORT OF REVENUES AND EXPENSES OF RAILROADS

MONTH OF SEPTEMBER, 1908.

See also issues of November 6 and 13.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with 1907.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama Great Southern	309	$181,374	$77,699	$286,666	$37,315	$56,517	$7,658	$91,258	$7,599	$200,347	$86,319	$107*	$11,489	$74,723	$2,380
Atchison, Topeka & Santa Fe	7,460	4,345,156	1,561,305	6,375,498	838,812	1,158,961	128,112	1,593,394	131,873	3,851,152	2,524,346	.....	265,113	2,259,233	255,377
Atlanta, Birmingham & Atlantic	642	111,571	35,468	154,359	17,083	23,922	9,109	52,707	5,223	108,044	46,315	.....	6,000	40,315	7,130
Buffalo & Susquehanna	373	171,996	20,044	197,826	37,359	40,815	2,890	64,868	7,261	153,193	44,633	149*	4,000	40,484	28,723
Central Branch	388	149,865	31,881	192,813	20,694	19,070	2,582	51,320	3,482	97,148	95,665	.....	9,500	86,165	84,623
Central New England	294	167,330	36,101	214,196	36,466	21,920	1,428	64,123	2,235	126,172	88,024	.....	5,600	82,424	38,953
Chicago & Erie	270	280,341	72,343	378,807	38,044	89,846	11,828	159,876	7,536	307,130	71,677	872	11,478	61,071	20,837
Chicago Great Western	818	539,542	194,246	789,718	130,228	127,756	38,381	300,052	27,459	623,876	165,842	1,162*	17,042	147,638	†1,410
Chicago, Indiana & Southern	329	193,084	24,457	225,186	16,585	47,909	7,208	83,182	6,539	161,423	63,763	1,800	15,000	50,563	26,556
Chicago, Rock Island & Gulf	493	129,102	64,401	205,438	53,355	21,734	5,430	80,132	7,562	168,213	37,225	147*	6,021	31,057	†24,523
Cincinnati, New Orleans & Tex. Pac.	337	495,833	125,408	651,988	93,528	144,522	15,718	179,622	16,416	449,806	202,182	1,139*	20,926	180,117	23,163
Duluth, Missabe & Northern	273	1,414,680	30,652	1,450,431	85,622	93,884	1,364	148,469	12,309	341,648	1,108,783	9,646	58,017	1,060,412	†247,545
Duluth, South Shore & Atlantic	593	134,141	89,304	237,717	41,487	26,883	10,160	83,295	5,644	167,469	70,248	2,128	15,000	57,376	†21,075
Evansville & Terre Haute	310	122,452	56,539	198,991	29,928	23,492	4,060	57,518	6,149	121,147	77,844	767*	9,035	68,042	†9,092
Galveston, Harrisburg & San Antonio	1,343	736,324	166,478	942,594	82,943	104,773	20,773	331,125	26,127	565,741	376,853	1,381*	18,985	356,487	192,126
Hocking Valley	347	538,092	93,174	648,110	64,264	127,955	7,968	164,229	12,869	377,285	270,825	8,207	20,981	258,052	4,289
Iowa Central	558	216,211	53,707	282,802	23,785	33,767	9,707	107,223	8,457	182,939	99,863	535*	7,363	91,965	†21,242
Mason City & Fort Dodge	386	120,265	41,020	171,403	21,747	23,153	1,739	63,163	611	110,413	60,990	1,817	6,000	56,807	5,228
Minneapolis & St. Louis	1,028	296,148	126,356	446,697	39,207	45,501	11,347	137,773	10,708	244,536	202,161	33*	17,367	184,761	40,897
Minneapolis, St. Paul & S. S. Marie	2,308	1,094,713	306,021	1,450,654	116,579	124,907	16,402	361,533	23,457	642,878	807,776	32,784	104,892	735,668	401,848
Missouri Pacific	3,492	1,429,818	398,998	2,010,952	234,233	302,360	39,423	730,495	51,120	1,357,631	653,321	332*	77,105	575,884	104,518
Morgans La. & Tex. R. R. & S. S. Co.	351	245,110	79,215	345,745	69,907	37,660	7,766	136,692	12,201	264,226	81,519	2,272*	14,900	64,347	62,146
Norfolk & Southern	582	116,162	52,750	184,193	33,829	17,719	4,000	56,280	12,068	123,896	60,297	1,805*	6,800	51,692	37,408
Northwestern Pacific	373	131,063	159,211	311,123	66,860	34,612	2,303	102,018	8,558	214,351	96,772	.....	9,230	87,542	†10,732
Philadelphia & Reading	1,007	2,687,986	537,792	3,375,638	283,712	605,773	40,260	995,648	49,845	1,975,238	1,400,400	58,440*	60,706	1,281,254	†180,016
Peoria & Eastern	352	164,603	71,547	260,273	32,362	32,742	5,244	89,930	4,169	164,447	95,826	.....	3,904	91,922	†1,709
Rutland	468	133,511	120,499	280,441	39,022	26,878	5,609	85,255	6,202	162,966	117,476	.....	8,337	109,138	2,931
St. Louis, Iron Mtn. & Southern	2,609	1,353,497	392,595	1,903,199	276,701	279,139	37,498	623,246	56,876	1,273,460	629,739	479*	65,605	563,655	42,818
St. Louis Southwestern	773	464,182	94,361	580,764	56,921	93,598	20,720	137,059	18,719	327,017	253,747	645*	15,025	238,077	†5,036
St. Louis Southwestern of Texas	697	226,906	76,545	323,488	66,996	66,917	7,550	136,542	13,928	291,933	31,555	155*	9,167	22,233	†6,580
Southern Pacific, Pacific System	5,582	4,425,964	2,214,156	7,120,270	940,316	821,700	98,388	1,852,158	190,694	3,903,256	3,217,014	6,992	214,610	3,009,396	697,379
Southern Pacific, Atlantic S. S. Lines.	.....	451,131	40,099	494,093	.....	.....	.....	.....	.....	424,748	69,345	3,719	.....	73,064	55,578
Texas & New Orleans	450	218,528	61,587	297,173	47,324	36,272	5,362	115,604	7,921	212,483	84,690	488*	7,406	76,796	5,447
Toledo & Ohio Central	441	392,684	78,606	484,848	59,561	65,508	5,592	120,733	4,608	256,002	228,846	9,893	14,048	224,691	47,844

THREE MONTHS—JULY 1, 1908, TO SEPT. 30, 1908.

Alabama Great Southern	309	$526,029	$279,846	$884,593	$102,096	$182,262	$22,252	$299,687	$25,720	$632,017	$252,576	$1,273*	$34,348	$216,955	$35,273
Atchison, Topeka & Santa Fe	7,460	12,170,129	4,653,458	18,227,189	2,317,478	3,272,094	354,504	4,713,962	371,334	11,029,372	7,197,817	.....	797,296	6,400,521	112,716
Atlanta, Birmingham & Atlantic	642	294,706	119,693	435,248	50,742	67,682	20,707	149,902	15,641	304,674	130,574	.....	18,000	112,574	24,451
Buffalo & Susquehanna	373	468,505	62,950	549,559	104,464	113,867	8,544	181,830	20,485	429,190	120,369	401*	12,000	107,968	43,231
Central Branch	388	345,029	95,405	474,585	58,830	47,447	7,878	143,575	10,924	268,654	205,931	.....	28,500	177,431	61,922
Central New England	294	403,643	102,172	538,569	112,079	63,582	4,135	177,878	7,314	364,988	173,581	.....	16,800	156,781	114,660
Chicago & Erie	270	742,499	222,014	1,048,133	124,915	245,860	32,424	463,678	21,919	888,796	159,337	1,208	34,435	126,110	†69,026
Chicago Great Western	818	1,381,474	595,016	2,135,162	307,997	324,525	110,013	843,057	90,756	1,676,348	458,814	1,162*	54,118	403,533	†62,112
Chicago, Indiana & Southern	329	546,013	75,112	642,005	95,944	121,053	23,674	251,193	21,058	512,922	129,083	4,050	45,000	88,133	†63,590
Chicago, Rock Island & Gulf	493	427,191	185,024	649,322	172,543	57,717	19,157	258,186	24,517	532,120	117,202	590*	15,527	101,085	†36,878
Cincinnati, New Orleans & Tex. Pac.	337	1,474,680	374,860	1,951,858	220,679	432,894	48,040	572,730	49,805	1,324,148	627,710	5,325*	58,926	563,459	86,453
Duluth, Missabe & Northern	273	4,330,208	87,759	4,433,668	249,216	273,695	3,066	453,778	34,861	1,014,616	3,419,052	31,623	178,497	3,272,178	250,014
Duluth, South Shore & Atlantic	593	367,515	276,295	686,381	126,851	75,011	28,952	239,993	22,943	493,750	192,631	7,949	45,000	155,580	†111,557
Evansville & Terre Haute	310	362,354	165,136	581,657	82,173	69,516	9,033	164,734	18,204	343,660	237,997	799*	27,105	210,093	19,520
Galveston, Harrisburg & San Antonio	1,343	1,824,214	519,716	2,463,964	251,545	281,596	57,499	984,676	81,161	1,656,477	807,487	4,528*	78,660	724,298	300,607
Hocking Valley	347	1,490,049	254,249	1,793,945	186,905	350,030	22,865	473,912	35,111	1,068,823	725,122	30,274	61,439	693,957	†25,606
Iowa Central	558	584,473	158,350	780,190	76,992	105,970	27,182	303,193	25,159	538,495	241,695	953*	22,186	218,556	†33,506
Mason City & Fort Dodge	386	341,549	127,374	499,122	60,471	64,962	5,092	183,757	1,920	316,202	182,920	1,817	18,000	166,737	5,311
Minneapolis & St. Louis	1,028	676,782	356,094	1,100,494	113,265	123,071	30,238	362,480	32,303	661,357	439,137	31*	45,865	393,241	12,163
Minneapolis, St. Paul & S. S. Marie	2,308	2,232,627	884,129	3,269,080	360,994	338,808	51,915	958,749	66,257	1,776,723	1,492,357	96,772	229,138	1,359,992	386,111
Missouri Pacific	3,492	4,108,266	1,133,125	5,761,396	702,172	741,889	119,710	2,146,938	176,269	3,886,978	1,874,418	64*	231,315	1,643,039	159,546
Morgans La. & Tex. R. R. & S. S. Co.	351	652,733	239,433	953,773	158,331	129,992	25,358	388,016	35,845	737,542	216,231	2,791*	44,700	168,740	190,542
Norfolk & Southern	582	315,055	184,644	546,214	107,691	65,384	14,140	182,276	40,693	410,184	136,030	4,218	20,400	119,848	19,538
Northwestern Pacific	373	368,759	559,423	989,023	193,968	109,630	6,559	295,716	27,231	633,104	355,919	.....	27,690	328,229	†42,371
Philadelphia & Reading	1,007	7,078,607	1,618,114	9,104,708	838,287	1,761,990	118,278	2,769,418	158,836	5,646,818	3,457,890	40,076	182,959	3,315,007	†1,269,604
Peoria & Eastern	352	460,037	196,392	715,550	98,889	87,515	16,348	262,008	12,824	477,584	237,966	.....	22,914	215,052	20,575
Rutland	468	377,766	338,366	796,502	113,199	89,639	19,103	272,857	16,794	511,592	284,910	.....	24,114	260,796	39,548
St. Louis, Iron Mtn. & Southern	2,609	3,803,520	1,134,476	5,400,143	783,315	694,160	114,912	1,852,508	169,170	3,614,065	1,786,078	359*	191,927	1,593,792	†105,194
St. Louis Southwestern	773	1,251,645	286,142	1,603,081	179,889	276,659	56,361	406,270	54,780	973,959	629,122	1,075*	45,075	582,972	†130,995
St. Louis Southwestern of Texas	697	587,396	239,547	885,378	221,308	203,612	24,239	393,371	42,570	885,101	277	599*	27,500	27,822*	†116,858
Southern Pacific, Pacific System	5,582	12,397,327	6,993,643	20,762,937	2,644,821	2,251,727	314,510	5,376,014	572,573	11,159,645	9,603,292	7,767	643,827	8,967,232	935,179
Southern Pacific, Atlantic S. S. Lines.	.....	1,265,327	145,473	1,422,293	.....	.....	.....	.....	.....	1,266,023	156,270	11,321	.....	167,591	†53,842
Texas & New Orleans	450	627,913	196,270	874,564	127,819	107,661	14,900	351,846	24,429	626,655	247,909	412*	29,756	217,741	11,425
Toledo & Ohio Central	441	1 115,426	204,036	1,361,624	175,854	194,447	16,413	369,217	15,521	771,452	590,172	18,940	41,216	567,896	75,615

*Loss. †Decrease.

The Missouri Rate Case.

Judge Smith McPherson, of the Federal court, took testimony last week at Kansas City, Mo., in the suit brought by 18 railroads to restrain the Railroad Commission and Attorney-General of Missouri from enforcing the state 2-cent fare and commodity freight rate laws. On November 14 the hearing was adjourned for two weeks. Judge McPherson said that when it was resumed it would be pushed rapidly; and he asked counsel to agree upon three cases to be tried together as a test of all 18 cases.

During the taking of testimony, Alexander Douglass, Fourth Vice-President and General Auditor of the St. Louis & San Francisco, said that the passenger earnings of his road were 13 per cent. less under the 2-cent fare than under the 3-cent fare; as many passengers were handled as before, but for less money. He said it cost $15 more to earn $100 carrying intrastate than interstate freight in Missouri on the basis of existing rates, which, of course, are higher than those fixed by the state legislature. W. B. Doddridge, formerly General Manager of the Missouri Pacific, said that the shorter a passenger's ride the greater the number of passengers a train had to haul to pay; that it cost the Missouri Pacific in Missouri an average of 4 cents for each passenger handled through a station. C. R. Gray, Vice-President of the St. Louis & San Francisco, said intrastate traffic on this road in Missouri was 20 to 30 per cent. more expensive to handle than interstate business. One reason for the difference was the greater risk involved in handling state business, owing to the more frequent stops and starts. The work done by engines and cars in local service also wore out equipment faster, owing to the same cause. C. Haile, Vice-President and Traffic Manager of the Missouri, Kansas & Texas, pointed out that owing to Missouri's geographical location reduction of rates in that state would disturb the fabric of rates throughout the country. Business to a large extent would be shifted from Chicago, St. Louis, Kansas City and other large centers; there would be more towns and small cities and few greater cities; this had been the result of the adjustment of rates in Iowa. A. D. Bethard, Assistant General Manager of the Missouri, Kansas & Texas, estimated that it cost 40 to 70 per cent. more to handle local than interstate business in Missouri.

Frank Hagerman, chief counsel for all the railroads carrying on the litigation, made a statement in which he said:

"It is very clear that, at the minimum estimate of any witness as to this extra cost, no railroad in the state can receive any return in excess of 2 per cent. of its valuation by the state board, either in the passenger or freight departments. In many instances, regardless of any extra cost in doing state business or payment of any interest charged, the earnings will not meet actual expenses.

"The Missouri case has another phase independent of the confiscatory nature of the law, which is that Missouri can pass no rate law that does not directly affect interstate rates. The great rivers, being on each side of Missouri make of themselves natural basing points, so that when a rate is fixed in Missouri it affects every state between the Rocky Mountains and the Atlantic seaboard. The Missouri Pacific is entirely within the state. When the Missouri Pacific reduces its rates to comply with the Missouri laws, the other roads must reduce their interstate rates."

Mr. Hill on the Future of the Northwest.

In a speech at Tacoma November 11 James J. Hill said that after the St. Paul road's coast extension is completed, no other transcontinental road will be built for many years. He said that the entire country north of the Platte river is now well occupied by railroads and that any new ones would fail to earn enough to justify their construction. High land prices and enormous cost of terminals, together with present low railroad rates, are factors that new lines cannot harmonize into profitable business. The present transcontinental lines must occupy themselves with building branch lines and feeders to properly develop their territory. Mr. Hill made a strong plea for the abolition of trade restrictions between the United States and Canada, and in connection with this plea prophesied that within the first half of the present century the United States would buy every bushel of wheat that Canada had to sell.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Cincinnati, Hamilton & Dayton is in the market for 20 locomotives.

The Ocean Shore has ordered two locomotives from the Baldwin Locomotive Works.

The Chicago, Cincinnati & Louisville expects to be in the market soon for locomotives.

The Union Pacific is preparing specifications for two heavy Mallet passenger locomotives.

The Missouri, Oklahoma & Gulf has ordered one locomotive from the Baldwin Locomotive Works.

The Dominion Coal Co. has ordered one six-wheel switching locomotive from the Montreal Locomotive Works.

The Isthmian Canal Commission will receive bids until December 7 on ten 3-ft. gage locomotives. (Circular No. 479.)

The Spanish-American Iron Co., Philadelphia, Pa., has ordered four locomotives from the Baldwin Locomotive Works.

The Birmingham Southern has ordered two switching locomotives from the Brooks works of the American Locomotive Co.

The Chicago & Alton is said to have ordered 30 locomotives from the Baldwin Locomotive Works. This item is not confirmed.

The St. Louis Southwestern, reported in the *Railroad Age Gazette* of October 23 as asking prices on locomotives, has ordered 25 locomotives from the Baldwin Locomotive Works.

The Northern Pacific, reported in the *Railroad Age Gazette* of November 6 as being in the market for three Atlantic and ten Pacific locomotives, has ordered this equipment from the Baldwin Locomotive Works.

The Missouri, Kansas & Texas, reported in the *Railroad Age Gazette* of October 23 as being in the market for six locomotives, has ordered 16 ten-wheel passenger locomotives from the American Locomotive Co.

The Virginian Railway was reported in the *Railroad Age Gazette* of October 30 as asking prices on 15 heavy Mallet compound freight locomotives and three switchers. An officer writes that negotiations for this equipment are not yet completed.

The Lehigh & Hudson River, reported in the *Railroad Age Gazette* of November 6, has ordered 12 simple locomotives from the Baldwin Locomotive Works, for December delivery. The specifications are as follows:

General Dimensions.

Weight on drivers	160,000 lbs.
Total weight	320,000 lbs.
Cylinders	22 in. x 28 in.
Diameter of drivers	56 in.
Boiler, type	Straight top
Boiler, working steam pressure	200 lbs.
Heating surface, tubes	2685.5 sq. ft.
" " firebox	178.2 " "
" " total	2863.7 " "
Tubes, number	336
" outside diameter	2 in.
" length	15 ft. 4½ in.
" material	Charcoal iron
Firebox, type	Wootten
" length	114 7/8 in.
" width	95 7/8 in.
Grate area	75.6 sq. ft.
Water capacity	7,000 gals.
Coal capacity	12 tons

Special Equipment.

Axles	Hammered steel
Boiler lagging	Asbestos mill board
Brakes	Westinghouse
Couplers	Climax
Driving boxes	Cast steel
Injectors	Sellers
Journal bearings	Bronze
Piston and valve rod packings	Jerome
Safety valve	Crosby
Sanding devices	Watters
Springs	Cast steel
Steam gages	Klinger
Tires	Cast steel
Valve gear	Stephenson

CAR BUILDING.

The Duluth & Iron Range is in the market for 1,000 50-ton steel ore cars.

The H. J. Heinz Co., Pittsburgh, Pa., is in the market for 25 refrigerator cars.

The Missouri Pacific is getting prices on five 60-ft. steel underframe postal cars.

The Canadian Pacific has ordered 500 box cars from the Dominion Car & Foundry Co.

The Detroit, Flint & Saginaw, Saginaw, Mich., is in the market for four interurban cars.

The Indian Refining Co., Cincinnati, Ohio, has ordered 75 tank cars from the German-American Car Co.

The Pittsburgh & Lake Erie is said to have ordered 1,000 forty-ton steel coal cars from the American Car & Foundry Co.

The Chicago, Wheaton & Western, Wheaton, Ill., has ordered three double-truck closed cars from the J. G. Brill Co., and will probably increase the order to five cars at an early date.

The Procter & Gamble Co., Cincinnati, Ohio, reported in the *Railroad Age Gazette* of October 23 as asking prices on one hundred 8,000-gal. tank cars, has ordered this equipment from the German-American Car Co.

The Virginian Railway was reported in the *Railroad Age Gazette* of October 30 as asking prices on 1,500 fifty-ton coal cars. An officer writes that negotiations for this equipment are not yet completed.

The San Antonio & Aransas Pass, reported in the *Railroad Age Gazette* of October 30 as being in the market for 500 box and 200 stock cars, has ordered this equipment from the American Car & Foundry Co.

The Missouri, Kansas & Texas, reported in the *Railroad Age Gazette* of October 23 as being in the market for 29 passenger coaches of different types, has ordered this equipment from the American Car & Foundry Co.

The Northern Pacific is said to have ordered the 63 passenger cars for which it was in the market, as reported in the *Railroad Age Gazette* of November 6. This report of the order being placed is not yet confirmed.

IRON AND STEEL.

The Colorado & Southern is figuring on 15,000 tons of rails.

The Wabash expects to be in the market soon for 15,000 tons of rails.

The Chicago, Burlington & Quincy is in the market for 40,000 tons of rails for 1909 delivery.

The Kansas-Colorado (Electric) has given the contract to the Colorado Fuel & Iron Co. for 1,400 tons of 70-lb. rails.

The St. Paul Bridge & Terminal Railroad is getting prices on 900 tons of structural steel for a bridge at Minneapolis, Minn.

The St. Louis & San Francisco has ordered 500,000 tie plates from the Railroad Supply Co., Chicago, and 50,000 lbs. of angle bars from another company.

The Pittsburgh Railways Co., Pittsburgh, Pa., has ordered 6,000 forged steel wheels from the Forged Steel Wheel Co., a subsidiary of the Standard Steel Car Co.

The National Railways of Mexico, according to press reports from the City of Mexico, has ordered 75,000 tons of 85-lb. rails from the Monterey Iron & Steel Co.

RAILROAD STRUCTURES.

CHICAGO, ILL.—The Chicago, Burlington & Quincy is having plans prepared for a passenger station and office building to be erected on the site of the present station at Western avenue and Fourteenth street. It is to be a three-story structure of pressed brick and stone, and will cost $75,000. The second floor will contain the waiting room. On the first and third floors will be the offices of the Superintendent, Trainmaster, Master Mechanic and other officers. It has not been definitely decided when this improvement will be made.

The Chicago & North-Western is taking figures on an elevated railroad station to be built at Clinton and Lake streets. It will be 120 ft. long, of steel and wood construction, and will cost $25,000.

IOWA FALLS, IOWA.—The contract recently given by the St. Paul & Des Moines to the Des Moines Bridge & Iron Works was for a steel plate girder bridge 380 ft. long to be built over the Iowa river. The cost of the bridge is $30,000. (Oct. 30, p. 1267.)

KANSAS CITY, MO.—A contract has been given to the Blodgett Construction Co. for the construction of a viaduct over the Kansas City Belt Line from Twentieth to Twenty-third streets. The structure will be 1,320 ft. long and 60 ft. wide, exclusive of 8-ft. sidewalks on each side. The estimated cost is $133,000.

LIVERMORE, CAL.—Thos. Day & Sons, San Francisco, Cal., were recently given contracts by the Western Pacific for the construction of new passenger stations at Livermore, Hayward and San Leandro, Cal. The stations are to be of the mission type of architecture. (Nov. 13, p. 1366.)

MILWAUKEE, WIS.—An officer of the Chicago & North-Western is quoted as authority for saying that the Allis station at National avenue and Barkley street will be enlarged and its passenger facilities improved.

WICHITA, KAN.—The Atchison, Topeka & Santa Fe has purchased seven blocks of land facing William street, adjoining the land now owned by the company, upon which it will build a new passenger depot, freight house and additional tracks. It is estimated that the improvements will cost $500,000.

WINNIPEG, MAN.—In addition to the contract for shops at Winnipeg, to cost $500,000, recently given by the Grand Trunk Pacific to Thomas Kelly & Sons, Winnipeg, announcement is made that the company has given contracts for three new stations at Watrous, Sask., Biggar and Wainwright, Alb., on the main line west, to the Carter-Halls-Aldinger Co., of Winnipeg.

Press reports say that contracts have been let for six new grain elevators on the Grand Trunk Pacific in Manitoba, and that farther west the company will, in the near future, put up others. (Oct. 30, p. 1267.)

YOUNGSTOWN, OHIO.—See Ohio Roads under Railroad Construction.

SIGNALING.

The Chicago, Rock Island & Pacific is installing block signals on its line, double-track, from Missouri Division Junction, near Davenport, Iowa, westward to Iowa City, 53 miles. The signals are three-position, electric motor semaphores, with the arms moving in the upper quadrant.

The Nashville, Chattanooga & St. Louis is building, with its own forces, a 32-lever interlocking plant at the crossing of the Belt line, Chattanooga, Tenn. At Johnsonville, Tenn., the drawbridge over the Tennessee river is being equipped with interlocking signals. The machine is the ordinary manual machine, but the signals are worked by electric motors. The electrical material was furnished by the Union Switch & Signal Co.

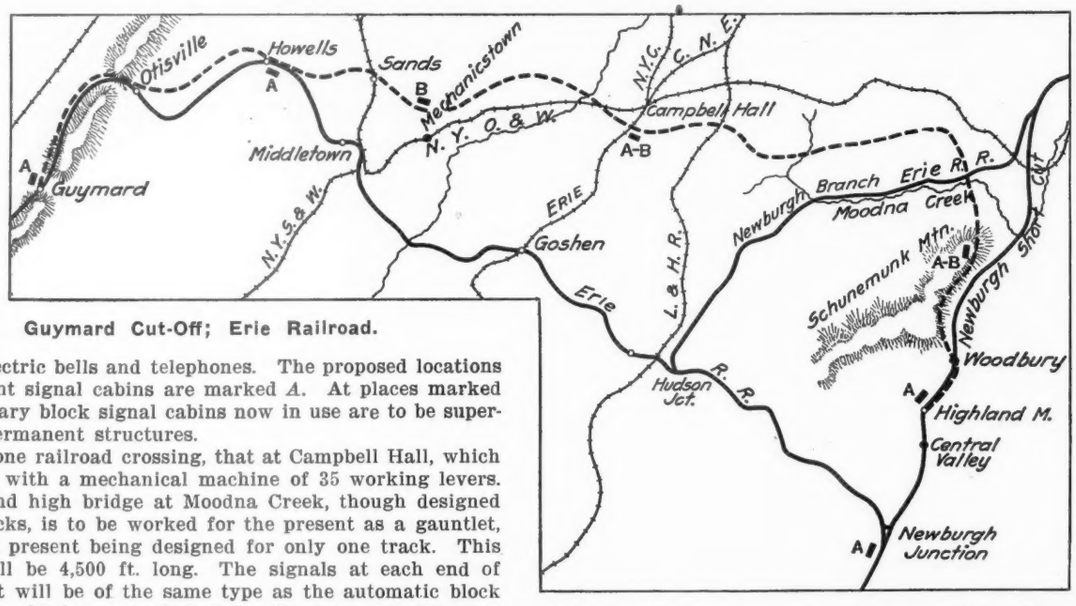
Contract for Hudson Tunnel Signals.

The Union Switch & Signal Co., Swissvale, Pa., has been awarded the contract to furnish and install the block and interlocking signals for the downtown tunnels of the Hudson & Manhattan, which are now nearly completed and which will be in operation within a few months. This pair of tunnels extends from Church street, New York, to the Pennsylvania station, Jersey City, and thence northward to a connection with the tunnel which is now in operation from the Delaware, Lackawanna & Western station in Hoboken to Morton

street, and thence to Twenty-third street, New York City. The contract includes four electro-pneumatic interlockings. The automatic block signals will be "light" signals, having no moving parts, and there will be electro-pneumatic automatic train stops, like those installed by the Union company in the Interborough Rapid Transit subway.

Signals on the Guymard Cut-Off.

The Guymard cut-off, the low-grade freight line of the Erie Railroad from Guymard, N. Y., to Highland Mills, near Newburgh Junction, which was described in the *Railroad Age Gazette* of November 6, will probably be put into operation from Guymard to Howells and from Campbell Hall to Newburgh Junction about December 1. The whole line is double-track and is to be equipped with automatic block signals; but until these signals are installed the trains will be regulated by manual block signals, with blocks averaging five miles in length. The temporary block stations at Howells, Campbell Hall and Moodna Creek are indicated on the map by the letter *B*. Cheap, temporary buildings will be erected for towers, except at points where there are interlocked signals and switches; and the signalmen will communicate with each other by electric bells and telephones. The proposed locations of permanent signal cabins are marked *A*. At places marked *A B* temporary block signal cabins now in use are to be superseded by permanent structures.



Guymard Cut-Off; Erie Railroad.

There is one railroad crossing, that at Campbell Hall, which is equipped with a mechanical machine of 35 working levers. The long and high bridge at Moodna Creek, though designed for two tracks, is to be worked for the present as a gauntlet, the floor at present being designed for only one track. This gauntlet will be 4,500 ft. long. The signals at each end of the gauntlet will be of the same type as the automatic block signals but will be controlled from the tower at the east end of the gauntlet, and will stand normally "stop." These signals will be controlled from a two-lever machine with lever lock attachments effected by track circuit, the circuits to be so arranged that it will be impossible for the operator to clear both the eastbound and the westbound signals at the same time; and they are also arranged so that the signals cannot be cleared by crosses or foreign currents. Mr. Willis, Signal Engineer, informs us that work on the automatic signals has just been begun. The signals and relays are furnished by the Union Switch & Signal Company, but the road will install the apparatus with its own forces. The signals are style "S" two-arm electric motor, the signal arms working in the lower quadrant. They will stand normally in the clear position, and the distant signals will be controlled by the track circuits through polarized relays, without line wires.

Exhibits at the Roadmasters' Convention.

There was a good representation of manufacturers and supply concerns at the Roadmasters' and Maintenance of Way Association's convention which was held at Hotel Blatz, Milwaukee, Wis., Nov. 10, 11 and 12. The list is as follows:

Allis-Chalmers Co., Milwaukee, Wis.—Bulletins of rock crushing plants, both portable and stationary; air compressors, and general machinery. Represented by F. W. Magin.

American Hoist & Derrick Co., St. Paul, Minn.—Photographs of the American railroad ditcher. Represented by Geo. Haigh and J. L. Hickey.

American Railway Device Co., Chicago.—Special tool grinder for hand cars; "Economy" separable switch point. Represented by O. Metcalf, Jr., and W. T. Smettem.

American Steel & Wire Co., Chicago.—Steel right-of-way fence. Represented by James M. Holloway and L. P. Shanahn.

American Valve & Meter Co., Cincinnati, Ohio.—Anderson's compound double automatic latch, Anderson's adjustable switch throwing crank; circulars and blueprints on Poage automatic water columns, and tank fixtures. Represented by F. C. Anderson.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Tie plates and railbraces. Represented by Lawrence Fitch.

Blood & Mead, Minneapolis, Minn.—Blood's staple puller. Represented by B. J. Mead.

Buda Foundry & Mfg. Co., Chicago.—Section motor cars, light inspection motor cars, velocipede motor cars; track jacks; Ramapo automatic switch stands; old and new style Paulus track drills; section of Buda pressed steel wheel; Buda carborundum tool grinder in two sizes. Represented by Lawrence Hamill, Geo. B. Shaw, W. C. Kidd, C. H. DeLano, W. P. Hunt, Jr., W. B. Paulson and L. M. Viles.

Carnegie Steel Co., Pittsburgh, Pa.—Advertising literature on steel ties. Represented by C. B. Friday.

Louis Dunn, St. Paul, Minn.—Switch and frog indicator. Represented by Louis Dunn.

Foster Main Line Interlocking Switch Stand, Columbus, Ohio.—Main line interlocking switch stand. Represented by Frank M. Foster and Geo. E. Kalb.

Wm. Goldie, Jr., & Co., Bay City, Mich.—Tie plugs. Represented by Wm. Goldie, Jr.

Hayes Track Appliance Co., Geneva, N. Y.—Four half-size models of Hayes' derails in operation, styles A5, C6, CX6 and E5. Represented by Arthur Gemunder, Columbus, O.; F. A. Preston, P. W. Moore, Chicago; S. W. Hayes, Geneva.

E. J. Iliff, Minneapolis, Minn.—Iliff tie tamper. Represented by E. J. Iliff.

H. W. Johns-Manville Co., New York.—Represented by T. M. Orr.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Represented by J. McKinnon.

Kane-Urtubee Co., Milwaukee, Wis.—Automatic vestibule safety step cover. Represented by T. H. Kane.

National Lock Washer Co., Newark, N. J.—Various patterns of lock washers. Represented by J. B. Seymour and G. E. Bake.

Otto Gas Engine Works, Chicago.—Represented by R. E. Gurley and T. W. Snow.

Quincy-Manchester-Sargent Co., Chicago.—Bonzano rail joint, anti-rail creepers (L. & S. No. 9, Racine No. 1, Q. & C. Bulldog, Murray); and Q. & S. step joint. Represented by G. C. Isbester.

Rail Joint Co., New York.—Base supporting rail joints; advertising literature. Represented by W. E. Clark, D. J. Evans, H. C. Holloway and F. M. Hill

Railroad Supply Co, Chicago.—Tie plates and advertising literature of derailers. Represented by M. J. Comorford and C. P. Cogswell.

Railway Specialty & Supply Co., Chicago.—P. & M. "boltless" rail anchors; Paine's vise-grip rail anchor. Represented by F. A. Preston and P. W. Moore.

Ramapo Iron Works, Hillburn, N. Y.—Ramapo switch stands and sections of rolled manganese rails. Represented by Arthur Gemunder.

M. M. Riley, Ironwood, Mich.—Models of metallic, wood-cushioned tie, and specially rolled rails. Represented by M. M. Riley.

Robinson-Tilton Machinery Co., Columbus, Ohio.—Advertising literature on the "Modern Right-Angle Drive." Represented by Geo. E. Kalb and Frank M. Foster.

J. M. Scott & Sons, Racine, Wis.—Models of "Little Giant" and "Hercules" bumping posts. Represented by J. M. Scott and E. E. Scott.

Sellers Mfg. Co., Chicago.—Tie plates and angle bars; advertising literature. Represented by Joseph T. Markham.

Thomas Boltless Rail Joint, Watertown, Wis.—Thomas patented rail joint. Represented by W. R. Thomas.

Universal Portland Cement Co., Chicago.—Advertising literature. Represented by Theodore S. Lazell.

U. S. Wind Engine & Pump Co., Batavia, Ill.—Switch stands, semaphores and catalogues of water supplies. Represented by C. E. Ward and R. E. Derby.

Verona Tool Works, Pittsburgh, Pa.—Specialties and supplies. Represented by O. Metcalf, Jr.

Winan's Improved Rail Joint, Portland, Ore.—Patented rail joint. Represented by A. Winan.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

G. S. Wright has been elected Secretary and Treasurer of the Evansville & Terre Haute.

H. M. Moors has been appointed Freight Claim Agent of the Southern Pacific at New Orleans, La.

J. N. Miller has resigned as Vice-President and General Manager of the St. Louis, Brownsville & Mexico.

W. D. Herring has been appointed General Claim Agent of the Houston & Texas Central, succeeding Clayton Herrington, assigned to other duties in the legal department.

Operating Officers.

Otto Holstein has been appointed Chief Train Despatcher of the Cerro de Pasco Railroad at Cerro de Pasco, Peru.

Henry J. Horn, formerly General Manager of the Northern Pacific, has been appointed General Manager of the C. Gotzian Shoe Co., St. Paul, Minn.

R. E. Woodruff has been appointed Trainmaster of the Erie at Galion, Ohio, succeeding C. G. Smith, who has been transferred to Cleveland, Ohio.

L. W. Baldwin has been appointed Superintendent of the Vicksburg division of the Yazoo & Mississippi Valley, with headquarters at Greenville, Miss., succeeding J. B. Kemp, retired on account of ill health.

E. E. Young, Superintendent of the McCook division of the Chicago, Burlington & Quincy, has been appointed Superintendent of the Sheridan division, with headquarters at Alliance, Neb. E. S. Kohler succeeds Mr. Young.

Gamble Latrobe, Acting Superintendent of the Union Railroad Co. of Baltimore, has been appointed Superintendent, succeeding H. W. Kapp, assigned to other duties. Mr. Latrobe also succeeds Mr. Kapp as Superintendent of the Baltimore division of the Northern Central.

Robert W. Baxter, recently appointed Superintendent of Transportation of the Lehigh Valley, was born in Scotland. He began railroad work on the Union Pacific as telegraph messenger boy, becoming successively telegraph operator, agent, Train Despatcher, Chief Despatcher, Assistant Superintendent and Superintendent on various divisions. In September, 1891, he was appointed Superintendent of the Baltimore & Ohio at Newark, Ohio, but in 1892 returned to the Union Pacific as Superintendent of the Oregon and Washington divisions. Later in the same year he became General Superintendent of the Pacific division at Portland, Ore., and two years later was made General Agent, Freight and Passenger department, for the receivers. From July, 1898, to 1903 he was Superintendent of the Nebraska division at Omaha. In July, 1904, he was appointed Superintendent of the Pennsylvania division of the Lehigh Valley, and in December of that year was made Superintendent of the Wyoming division. In January, 1906, he was appointed Superintendent of the Buffalo division, which position he held until his recent appointment.

R. W. Baxter.

C. T. O'Neal, whose appointment as Superintendent of the Buffalo division of the Lehigh Valley we announced last week, was born at Brandywine Springs, Del. He began railroad work in 1890 as clerk in a Trainmaster's office on the Philadelphia & Reading. In 1891 he was made clerk in the office of the Superintendent of Transportation at Philadelphia, Pa., and two years later became clerk for the California Fruit Express in Chicago. The next year he was made clerk in the General Superintendent's office of the Lehigh Valley at South Bethlehem, Pa. From 1898 to 1904 he was successively clerk, private secretary and chief clerk to the Superintendent of Transportation, the General Superintendent and the General Manager of the Lehigh Valley. In 1905 he became Trainmaster of the Pennsylvania division, and a year later was appointed Trainmaster of the New Jersey & Lehigh division. In the first part of 1908 he was made Superintendent of the New York division, which position he held until his recent appointment.

C. T. O'Neal.

Traffic Officers.

M. B. Muxen has been appointed Traveling Passenger Agent of the Chicago & Eastern Illinois at Dallas, Tex.

A. F. Massey has been appointed New England Passenger Agent for the Missouri Pacific, with office at Boston, Mass.

J. S. Etchberger has been transferred as Traveling Freight Agent of the Seaboard Air Line from Atlanta, Ga., to Columbia, S. C.

R. A. Chadwick has been appointed Assistant General Freight Agent of the Tennessee Central, with office at Nashville, Tenn.

G. M. Graybell has been appointed Traveling Passenger Agent of the Great Northern at Boston, Mass., succeeding Jonathan Story, resigned.

J. F. Constans has been appointed General Agent, Freight department, of the Chicago, Peoria & St. Louis, with office at room 524, Park building, Pittsburgh, Pa.

Charles D. Golding, Commercial Agent for the Rock Island-Frisco Lines at Houston, Tex., has resigned to go to the Pedent Iron & Steel Co., effective December 1.

W. H. Whittaker has been appointed District Passenger Agent of the Northern Pacific, with headquarters at Detroit, Mich., succeeding Percy P. Armitage, resigned.

The office of Commercial Agent of the Colorado & Southern at Baton Rouge, La., has been abolished, and Samuel T. Pries, Commercial Agent, has been transferred to New Orleans, La.

C. E. Stone, formerly General Passenger Agent of the Great Northern, was recently elected to the Minnesota Legislature from the Thirty-sixth district (St. Paul) on the Republican ticket.

E. T. Reynolds remains Traveling Freight Agent of the Pere Marquette at New York, there being no eastbound agent at New York, but Mr. Reynolds will hereafter look after eastbound shipments particularly.

W. E. Rose, whose resignation as Freight and Ticket Agent of the Pennsylvania Lines West at Dola, Ohio, was announced in these columns some time ago, has been appointed Freight and Ticket Agent of the Ohio Central at Dunbridge, Ohio.

William P. Fitzsimmons, who has been Manager of the Bureau of Transportation and Manufactures of the Board of Commerce at Detroit, Mich., for the past year, has resigned, effective December 1. Mr. Fitzsimmons was for several years with the general freight department of the Grand Trunk, having been during recent years, successively, Chief Clerk to the General Freight Traffic Manager at Montreal; Division Freight Agent at Detroit, and Manager Lackawanna-Grand Trunk Line at Chicago.

Engineering and Rolling Stock Officers.

Bert Archibald has been appointed Roadmaster of the First division of the Bangor & Aroostook, with headquarters at Milo Junction, Me., succeeding E. M. Bassett, deceased.

J. D. Harris, Works Manager of the Westinghouse Air Brake Co. at Pittsburgh, Pa., has been appointed General Superintendent of Motive Power of the Baltimore & Ohio, succeeding J. E. Muhlfeld, resigned.

Edward Elden, formerly Master Mechanic of the New York Central & Hudson River and the Lake Shore & Michigan Southern at Buffalo, N. Y., has gone to the Dodge Manufacturing Co., Mishawaka, Ind., as Chief of Sales of the Railroad Department.

J. W. Stone, Assistant Engineer of the Tyrone division of the Pennsylvania, has been appointed Assistant Engineer of the Chautauqua division, with office at Oil City, Pa., succeeding W. T. Covert, transferred. H. S. Meily, Assistant Engineer of the Buffalo division, succeeds Mr. Stone. J. R. McGraw succeeds Mr. Meily, with office at Buffalo, N. Y.

John W. Ennis, Supervisor of Track of the Western division of the New York Central & Hudson River, has been transferred from North Tonawanda, N. Y., to Rochester, and will have charge of the line between Rochester and Niagara Falls, including the Auburn branch. The track between Buffalo, Niagara Falls, North Tonawanda and Lockport Junction will be part of the Buffalo division.

OBITUARY.

O. W. Barnes, a civil engineer, and at one time Chief Engineer of the proposed South Pennsylvania Railroad and at another time Chief Engineer of the New York & Long Island Railroad, died of pneumonia on November 14 at his home in New York.

Edward D. Hayden, Vice-President and Secretary of the Boston & Albany, died of apoplexy on November 15. He was 74 years old, a graduate of Harvard College 1854, and after studying and practising law and holding various positions of prominence in public life, became Vice-President, Secretary and Director of the Boston & Albany.

I. Y. Sage, formerly General Superintendent of the Atlanta & Charlotte Air Line and the Georgia Pacific, now part of the Southern Railway, died from pneumonia on November 14 in Atlanta, Ga. Mr. Sage was 60 years old. He was born in Middletown, Conn. He was one of the builders of the Georgia Pacific from Atlanta to Birmingham in 1868, and later he built the line of the Seaboard Belt around Atlanta, Ga., doing the work in 87 days.

E. V. Skinner, Assistant Traffic Manager of the Canadian Pacific, with office at New York, died at his home in Yonkers, N. Y., November 7 from a stroke of apoplexy. He was born in 1849 in London, Eng. After a public school education in Charlestown, Mass., he began railroad work in 1879 as Passenger Agent of the New York, Lake Erie & Western, now the Erie. In 1881 he was made Passenger Agent of the Pennsylvania, and in 1885 was appointed General Eastern Passenger Agent of the West Shore. When the West Shore was taken over by the Vanderbilt interests he became General Eastern Agent of the Canadian Pacific, and in 1904 was made Assistant Traffic Manager.

Railroad Construction.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—See Ohio Roads.

CALGARY & KNEEHILL.—This company, recently incorporated to build a line from Calgary, Alb., northerly to Kneehill creek, will apply for an extension, to March 15, of the time within which the first 30 miles of line is to be built, and a further extension of two years from that date for the completion of the rest of the line. (Sept. 25, p. 1026.)

CLINTON, OKLAHOMA & WESTERN.—Incorporated in Oklahoma, with a capital stock of $500,000, to build a railroad from Clinton, Okla., west through Butler and Cheyenne to Canadian, Tex., thence northwest to Colorado Springs, Colo., about 400 miles. From Clinton the survey runs westward through the counties of Custer, Roger Mills, Ellis, Woodward, Harper, Beaver, Texas and Cimarron, thence across the corner of New Mexico. The charter also includes a line eastward from Clinton. Incorporators include T. J. Nance, C. H. Lamb, E. A. Humphrey and J. T. Bradford, all of Clinton.

ERIE.—The report of this company for the year ended June 30, 1908, says under date of October 13 that work on the low grade line from Guymard, N. Y., east to Highland Mills has been continued during the year, together with the revision of a section of the existing road from Highland Mills to Newburgh Junction. It is expected that the work will be finished and the line ready for operation early in 1909. (Nov. 6, p. 1292.)

No further progress has been made on the construction of the Erie Terminals Railroad and the Suffern Railroad. The former was organized in New Jersey to build a line from a point on the state line between New York and New Jersey near Suffern, N. Y., southeast through New Jersey to the Hudson river. The Suffern Railroad was chartered in New York to build from a connection with the Erie Terminals Railroad to Suffern. These improvements were planned to provide low grade, and additional facilities between Jersey City, N. J., and Port Jervis, N. Y.

The Columbus & Erie was organized to carry out the part of the work in Pennsylvania, between Columbus, Pa., and Niobe, N. Y., 13 miles, on grade improvements to be made between Port Jervis, N. Y., and Chicago. The plans call for the construction of a single-track line from Columbus to Niobe, and a low-grade double-track line from Niobe to Lakewood, N. Y., a total of 22.8 miles. Satisfactory progress has been made on this work during the year, and it is expected to have all the work finished and the line ready for operation early in 1909.

Progress has been made on the construction of the Genesee River Railroad, building a low grade line from Cuba, N. Y., north to Hunts, 33 miles. It is expected that work will be started improving the existing line between Salamanca and Cuba and between Hunts and Hornell, to be used in conjunction with the Genesee River Railroad, when work on that line is finished.

Work on the Pennhorn Creek Railroad, which was organized several years ago, has been resumed under modified plans and will be pushed to completion. These improvements are being made to relieve the congestion of both passenger and freight traffic at the Jersey City, N. J., terminal, and to provide facilities for additional passenger train service. The plans include the construction of a four-track railroad through an open cut in Bergen Hill and two tracks over a viaduct, laid on foundations with room for four tracks, east of Bergen Hill to a connection with the present passenger tracks. Connection will be made west of the tunnel with the existing line, permitting exclusive use of the present tunnel for freight traffic. To provide for enlargement of present facilities, additional land has been bought at Jersey City, N. J., at Port Jervis and at Hornell, N. Y., Youngstown and Akron, Ohio, Hammond, Ind., and at Chicago. (March 13, p. 391.)

During the fiscal year the company started work on the reconstruction of 62 bridges. There was laid a total of about 26,000 tons of new 90-lb. rail, and 3,200 tons of new 80-lb. rail; 105 miles of track were fully ballasted, and 56 miles partially ballasted. Fourteen miles of passing and

other company's sidings, and 4.6 miles of industrial side tracks were constructed. A new passenger station was built at Scranton, Pa., and a general storeroom at Susquehanna, Pa.

EVANSVILLE, MT. CARMEL & OLNEY (ELECTRIC).—Press reports indicate that the contract for surveying this line from Evansville, Ind., southwest to Olney, Ill., about 60 miles, will be let at an early date. (R. R. G., February 28, p. 297.)

FAIRBURN & ATLANTA RAILWAY & ELECTRIC COMPANY.—Application has, it is said, been made by this company for a charter in Georgia to build a line from Fairburn, Ga., via Stonewall and Red Oak, to College Park, about 10 miles, where connection is to be made with the street railway to Atlanta. W. T. Roberts, President, and J. H. Logino, Treasurer, both of Fairburn.

IOWA & OMAHA SHORT LINE.—This company was recently organized in Iowa with $1,000,000 capital to build a line between Council Bluffs, Iowa, and Des Moines, 125 miles. An officer writes that all the preliminary surveys have been made. The grade will be less than 1 per cent. and will average 80 per cent. tangent. People of interested localities are giving material aid in the form of township taxes, stock subscriptions and donated right-of-way. The company is seeking offers for its bond issue, and G. W. Adams, of Walnut, Iowa, President of the company, will soon make a trip to Des Moines, Iowa, St. Louis, Mo., Chicago, Cleveland, Ohio, Philadelphia, Washington, D. C., and Baltimore, Md., to select locomotives, cars and steel for the track. The track will be laid with 75 or 80-lb. rails. General offices are at Walnut, Iowa. The officers are: G. W. Adams, President; C. L. Kirkwood, Vice-President, both of North Branch, Iowa; Peter Kaghmann, Secretary, Treynor, Iowa; Orren Mosher, General Attorney, Walnut, Iowa; Directors, S. P. Schultz and Arthur Saar, Treynor, Iowa; V. V. Spangler and G. L. Hartis, North Branch, Iowa, and Charles Peterson, Walnut, Iowa. (Nov. 13, p. 1374.)

LYNNHAVEN TERMINAL CORPORATION.—Organized in Virginia, with headquarters at Norfolk, to operate about 50 miles of railroad from Norfolk, Va., east to Lynnhaven, through the counties of Norfolk and Princess Ann, also in Northampton county from Cape Charles. The company proposes to acquire existing lines, or build its own line, to construct a breakwater in Lynnhaven, and operate wharves, docks and warehouses. A. H. Martin, President, and J. E. Cole, Secretary, both of Norfolk.

LOUISVILLE & NASHVILLE.—An officer writes that this company on November 9 began operating its Pine Mountain branch from Savoy, Ky., to coal fields at Pine Mountain, 17 miles. (R. R. G., March 13, p. 392.)

METO VALLEY RAILROAD.—Incorporated in Arkansas with $32,000 capital to build a railroad from McCreanor, Ark., on the line of the Chicago, Rock Island & Pacific, south, through Lonoke county, about 16 miles. This road is intended to develop timber lands in this section. It is said that work on the line will commence at once. Incorporators include E. C. Murray, S. M. Savage, C. P. Harnwell, E. S. Jett and R. J. Strong.

MEXICAN CENTRAL.—Press reports from Mexico say that service is to be inaugurated on the Manzanillo extension December 1. Trains are now being operated for both freight and passenger service on a temporary schedule. The line extends from Tuxpan, Jalisco, to Colima, the capital of Colima, 45 miles. Hampson & Smith, of Mexico City, were the contractors. (R. R. G., April 24, p. 591.)

MISSISSIPPI ROADS.—J. K. Buckwalter, of Union, Miss., will, it is said, build a logging road from Union, east, about nine miles.

NEW YORK, NEW HAVEN & HARTFORD.—The Providence Terminal Co., which has been building a double-track tunnel from the main line station at Providence, R. I., under the river to East Providence, opened this tunnel for passenger traffic on November 15. (R. R. G., March 13, p. 392.)

NEZPERCE & IDAHO (ELECTRIC).—The grading work on this line between Nezperce, Idaho, and Vollmer, has been completed with the exception of 1½ miles. The placing of ties and steel will be commenced at once. (Oct. 16, p. 1177.)

NORFOLK DOCK & TERMINAL.—This company has, it is said, been granted a charter in Virginia with $500,000 capital to build docks, railroad terminals and other structures on about 120 acres of land, which has a 2,000-ft. frontage on deep water, in Berkley, opposite the Norfolk navy yard. P. E. Griffith, President, and J. M. Umstadter, Secretary and Treasurer, Norfolk.

NORTHERN PACIFIC.—Track laying on the extension from Cul de Sac, Idaho, southeast to Grangeville, 55 miles, is said to have been finished. This line will be operated jointly with the Riparia-Lewiston branch of the Oregon Railroad & Navigation Co.

NORTHWESTERN PACIFIC.—Contract is said to have been given by this company to J. H. Wilkins, of San Francisco, Cal., to build a cut-off from Corte Madera, Cal., northeast to Green Brae, two miles.

OCEAN SHORE.—The line formerly running from San Francisco, Cal., south to Granada has been extended to Arleta Park, three miles, and the line formerly running from Santa Cruz, Cal., to Folber has been extended to Swanton, 1½ miles. (Sept. 4, p. 889.)

OHIO ROADS.—Press reports say that the Pennsylvania Lines West, the Baltimore & Ohio and the Pittsburgh & Lake Erie have received instructions from the city officials of Youngstown, Ohio, to prepare plans for the elimination of all grade crossings in that city. The plans must be completed within six months. All the railroads have agreed to begin work at once on the improvements.

OREGON & WASHINGTON.—Bids are asked for the construction of the Tacoma, Wash., tunnel, which is to have its north portal between Twenty-third and Twenty-fifth streets and Jefferson avenue and Hood street. It will be 8,700 ft. long, and for two tracks. It will have a maximum grade of 1.25 per cent. and will necessitate the removal of approximately 460,000 cu. ft. of earth. About one-half mile of steel construction, in addition to a new drawbridge, is included in the plans. The estimated cost for the tunnel is $3,000,000, and for the steel work $2,000,000. It has not been decided when the contract will be awarded or when construction will be begun.

PENNSYLVANIA LINES WEST.—See Ohio Roads.

PITTSBURGH & LAKE ERIE.—See Ohio Roads.

SHREVEPORT NORTHEASTERN.—An officer is quoted as saying that work will be finished on this line from Shreveport, La., northeast via Minden to Homer, 47 miles, by the first of January, 1909. The line is projected north to Eldorado, Ark., and to Memphis, Tenn., a total of 285 miles. Between Minden and Homer, 20 miles, there remains about one mile of track to be laid. (Oct. 30, p. 1276.)

SOUTHERN WISCONSIN (ELECTRIC).—H. H. Ziegler, President of the Cincinnati Construction Co., building this line from Madison, Wis., to Janesville, about 40 miles, announces that the line will be ready for operation on or about October 1, 1909. Active construction work will begin about December 1. All surveys are completed.

STAMFORD & NORTHWESTERN.—An officer of this company writes that it is expected that work will be started on this line about January 1, from Stamford, Texas, northwest to a point in Dickens county, about 65 miles. The chief engineer is at Stamford.

TEXAS SOUTHEASTERN.—An officer of this company writes regarding newspaper reports that the company is to build an extension to Crockett, and eventually to Waco, that surveys have been made, but no further information is available at present.

WESTERN PACIFIC.—An officer writes that regular commercial traffic was inaugurated on the Eastern division of this road November 9, from Salt Lake City, Utah, west to Shafter, Nev., about 160 miles, where connection is made with the Nevada Northern. Main track has been laid from Salt Lake City west for about 235 miles. At a point 170 miles west of Salt Lake City, the Flower Lake Pass tunnel, which is to be 5,600 ft. long, is nearly finished, and it is expected that trains will be running through the tunnel before the end of this month. (Nov. 13, p. 1375.)

Railroad Financial News.

Alberta Railway & Irrigation.—An initial dividend of 4 per cent. has been declared on the common stock. This road, controlled by the Canadian Pacific, runs from Lethbridge, Alberta, to Sweetgrass, on the Montana line, and to Cardston, a total of about 113 miles.

Atlantic City & Suburban.—The property of this company, which went into the hands of a receiver about two years ago, has been sold for $91,000 to Robert Wetherill, who represents a committee of the bondholders. The road runs from Atlantic City to Somers Point and Absecon, 18 miles.

Baltimore & Ohio.—L. F. Loree has been elected a director, succeeding Charles Steele, resigned.

Boston Elevated.—Stockholders are asked to vote to authorize $7,000,000 new stock and to fix the price. If this plan is approved it will rescind the vote of April 30, 1907, to increase the capital stock from $13,300,000 to $21,300,000.

Central Vermont.—See Grand Trunk.

Chicago Consolidated Traction.—Default was made in interest due November 1 on the following underlying bonds: Chic. & Jeff. Urb. Tran. 6 per cent., $208,000; Cicero & Proviso St. Ry. 5 per cent., $2,000,00; Ogden Street Ry. 6 per cent., $750,000; North Side Elec. St. Ry., $155,000.

Cleveland Railway.—See Municipal Traction Co.

Colorado & Southern.—The directors declared on November 13 an initial dividend of 2 per cent., payable December 15, 1908, on the $31,000,000 common stock.

Detroit, Toledo & Ironton.—The collateral securing $5,500,000 5 per cent. notes of the Detroit, Toledo & Ironton is to be sold at public auction on December 1 for the account of the United States Mortgage & Trust Co. This consists of $5,000,000 4½ per cent. consolidated mortgage bonds of 1905-1980 of the Detroit, Toledo & Ironton, and $3,001,000 preferred stock of the Ann Arbor and $2,190,000 common stock of the Ann Arbor. (Nov. 13, p. 1376.)

Erie.—William Salomon & Co., New York, are offering $2,736,000 car trust 5 per cent. notes at a price to yield 4¾ per cent. This is part of an issue of $3,040,000 dated October, 1897, and due semi-annually, April 1 and October 1, up to and including 1917.

Grand Trunk.—The Central Vermont Transportation Co. has been organized, in the interest of the Grand Trunk and the Central Vermont, to run freight steamers between New London, Conn., the southern terminus of the Central of Vermont, and New York City; authorized capital $200,000. The freight steamers now used for this business are owned by the New York, New Haven & Hartford, but the new company will now buy steamships at once, it is said.

Houston Belt & Terminal.—R. C. Duff has been elected a director, succeeding Herman Hall.

Illinois Central.—The directors have authorized an issue of $110,000,000 refunding mortgage 4 per cent. bonds of November 1, 1908-1955, and $20,000,000 of these bonds have been sold to Kuhn, Loeb & Co., who have in turn resold them to the public. The proceeds from the sale are to be used to pay off the floating debt and place the company in funds. Of the remaining authorized bonds, $58,766,000 are reserved to retire prior lien bonds, and $31,234,000 are reserved for construction of additional main track and other corporate purposes. An additional $10,000,000 may be issued to buy the property of the Indianapolis Southern, and in that case the lien of the refunding mortgage is to be extended to cover as a first mortgage the property of that company. The mortgage securing these bonds, it is said, will be on 2,012 miles of road on the main line of the company and on the Springfield division, the St. Louis division, the Chicago, Havana & Western, the Rantoul Railroad, and the Cairo bridge approach, and also on the Chicago terminal. This mortgage will be subject to existing issues of bonds amounting to $58,766,000. The new bonds were sold to the public at 98.

Metropolitan Street Railway (New York).—A joint committee has been formed to represent the general and collateral 5 per cent. bondholders committee and the refunding 4 per cent. bondholders committee. This committee consists of Donald Mackay and William P. Dixon, representing the general and collateral 5s, and John W. Castles and Otto H. Kahn, representing the refunding 4s. In addition, Alexander J. Hemphill, chairman of the general and collateral 5 per cent. bondholders committee, and E. S. Marston, chairman of the refunding 4 per cent. bondholders committee, are to co-operate with the joint committee in its work and conferences. John W. Castles is chairman and Alexander J. Hemphill is secretary of the joint committee.

Municipal Traction Co.—Judge Tayler, of the United States Circuit Court, has appointed Warren Bicknell and F. A. Scott receivers in the suit brought by the trustee of the three issues of bonds of the Cleveland Railway aggregating about $9,000,000. The court says that the Municipal Traction Co. since it lost the lease of the Cleveland Railway lines has almost no assets. The Municipal company recently refused to turn over the street railway lines to the Cleveland Railway.

Pere Marquette.—The property of the Barry Transportation Co., of Milwaukee, Wis., was sold to representatives of the Pere Marquette for $80,100. A line of steamers for freight and passengers will be run between Milwaukee and Chicago in connection with the Pere Marquette.

Philadelphia Rapid Transit.—George H. Earle, Jr., on November 10 resigned as a director of the company.

Philippine Railway.—William Salomon & Co., New York, are offering $4,000,000 first mortgage 4 per cent. sinking fund bonds of 1907-1937 at 95, on which the interest is guaranteed by the Philippine Government. This is part of an authorized issue of $15,000,000, of which $4,305,000 was outstanding October 31, 1908.

Tarrytown, White Plains & Mamaroneck (Electric).—Foreclosure suit has been brought by the Knickerbocker Trust Co. under the first mortgage securing $300,000 bonds against this 23-mile electric road which runs from Tarrytown, N. Y., to Mamaroneck.

Wheeling & Lake Erie.—The receivers have issued $1,820,000 6 per cent. certificates, being part of a total issue of $1,859,000 authorized by Judge Tayler in the Federal court.

Supply Trade News.

The Pittsburgh, Pa., office of the Ernst Wiener Co., New York, will in the future be in the Union Bank building, with John T. Cawley in charge.

The U. S. Metal & Manufacturing Co., 165 Broadway, New York, has been appointed eastern sales agent of the Hutchins Car Roofing Co., Detroit, Mich.

Walter B. Snow, Publicity Engineer, Boston, Mass., has been appointed by Governor Guild a member of the Massachusetts Commission for the Blind.

The Rail Joint Co., New York, recently bought from Arthur L. Stanford, Railway Exchange, Chicago, the patent covering the rail joint described in the *Railroad Gazette* of May 3, 1907, p. 627.

J. D. Harris, Works Manager of the Westinghouse Air Brake Co. at Pittsburgh, Pa., has been appointed General Superintendent of Motive Power of the Baltimore & Ohio, succeeding J. E. Muhlfeld, resigned.

The Illinois Car & Manufacturing Co., Chicago, has been incorporated with a capital of $100,000 to engage in general manufacturing business. The incorporators are P. H. Joyce, Geo. J. Kuebler and P. J. Finnegan.

Robert W. Hunt & Co., Chicago, have been given a contract by the Chicago & North-Western for the inspection of the structural materials in the new terminal station, of which the steel will amount to about 24,000 tons.

Edward Elden, formerly Master Mechanic of the New York Central & Hudson River and the Lake Shore & Michigan Southern at Buffalo, N. Y., has gone to the Dodge Manufacturing Co., Mishawaka, Ind., as Chief of Sales of the Railroad Department.

Benson E. Brown has resigned as Vice-President and Manager of Sales of the J. B. Sipe Co., Pittsburgh, Pa., and has been elected President of the Regal Paint & Oil Co., 475 Trombley avenue, Detroit, Mich., which makes railroad paints, oils and varnishes.

The Dressel Railway Lamp Works, New York, has enlarged its factory and increased its facilities. New and improved machinery has been purchased and installed, the factory has been rebuilt, and all departments reorganized. The expense was from $50,000 to $60,000.

Charles R. Day, formerly with the Midvale Steel Co., Philadelphia, Pa., has become Sales Agent for the U. S. Metal & Manufacturing Co., New York. Mr. Day will give especial attention to the introduction of the Diamond steel pole, for which this company recently became agent.

The Independent Pneumatic Tool Co., Chicago, has received many orders for its Thor pneumatic tools and appliances from railroads, foundries, machine shops and boiler and iron works. The company says that during the month of October the orders and inquiries showed an increase of approximately 25 per cent. over any other month during the present year.

At a meeting of the directors of the Barney & Smith Car Co., held in Dayton, Ohio, November 12, A. M. Kittredge was elected President, succeeding J. D. Platt, who resigned on account of ill health after serving as President for many years. H. M. Estabrook is promoted to Vice-President to succeed Mr. Kittredge. Mr. Kittredge was first associated with the company in January, 1884, as Assistant Superintendent. He was made Superintendent in 1888 and Vice-President in 1900. The Barney & Smith Car Co. is successor to the firm of Barney & Thresher, which was established in 1849. In April, 1908, a banquet was given by the company to all employees who had been in its employ more than 25 years, which was attended by more than 180 employees. Among those, one, John McBride, had a record of 54 years' service. Another, Thomas Bentley, had served 52 years. There were several who had served between 45 and 50 years. As an illustration of the growth of the railroad coach business, the enlargement of the Barney & Smith Company in the last 25 years is suggestive. In that interval, the output of the plant has been increased more than ten-fold.

A. M. Kittredge

The American Valve & Meter Co., Cincinnati, Ohio, says that it has had a remarkably large increase in orders since election day. It attributes much of the recent influx of orders to the letting go of suspended orders contingent on the result of the election, but it anticipates a good deal of business and is making every preparation for having stock on hand. It cannot now foresee anything to hamper business for the next three or four years.

The Isthmian Canal Commission, Washington, D. C., is asking bids until December 9 for 12 steam towing machines (Circular No. 480). Bids are asked until December 14 on two water-tube boilers, with stack, breeching, up-takes and fittings, surface condenser, generator and engine, brake-rod connection pins, brake-shoe keys, truck-bolster center plates, coupler knuckle pins, steel tubing, gaskets, mortising chisels, machine bits and bitstocks (Circular No. 481). Bids are asked until November 24 on 10 4-yard rock dippers (Circular No. 480A).

The Railway Chemical Sprayer Co., Owensboro, Ky., during the season of 1908, has killed the grass and weeds along the roadbed of the Illinois Central for approximately 500 miles, the work extending over portions of that system between New Orleans, La., and Dubuque, Iowa. The Railway Chemical Sprayer Co. operates its system by a chemical tank car with a sprinkler attached, the work being done under guaranteed contract. The killing of the vegetation along the Illinois Central tracks has proved so successful that two cars will be used next season on this road instead of one. A number of Eastern roads expect to adopt, during 1909, this system.

G. M. Lowry, General Manager of the American, the Columbus and the Indiana Creosoting Companies, with main offices in Chicago, was killed on November 12 in a rear end collision while en route on the New Orleans & North Eastern from Slidell to New Orleans, La. He was born at Shelbyville, Ky., in 1858, and received his education at the Kentucky State College. For many years he was connected with the Southern Creosoting Co. at Lexington, Ky. He was the inventor of the Lowry process of creosoting, the patents for which are controlled by the American Creosoting Co. His connection with this company dates from its origination about six years ago.

TRADE PUBLICATIONS.

Ruberoid.—The November issue of *The Exchange*, published by the Standard Paint Co., New York, is accompanied by an index of volumes VI. and VII.

Reinforced Concrete.—The Trussed Concrete Steel Co., Detroit, Mich., is distributing a two-page folder describing the method of concreting in freezing weather.

Derailer.—The R. R. S. derailer is described in a catalogue recently issued by the Railroad Supply Co., Chicago. A number of half-tones and line drawings show the derailer in place and in actual operation.

Rail Joint.—The improved Thomas boltless rail joint is illustrated and described in a catalogue published by W. R. Thomas, Watertown, Wis. The manufacturer claims many advantages for this type of joint.

Tie Plates.—The Railroad Supply Co., Chicago, has issued a unique catalogue devoted to Wolhaupter shoulder flange tie plates. Several pages are given to the results of various tests of the Wolhaupter and other joints.

Logarithmic Paper.—J. Norman Jensen, Civil Engineer, Chicago, is mailing a 11-in. x 11-in. sheet of logarithmic cross-section paper, on the reverse side of which the advantages, directions for using, etc., are fully described.

Milling Machines, etc.—The Pratt & Whitney Co., Hartford, Conn., has just issued one of its standard 9-in. x 12-in. catalogues, printed on heavy paper, describing milling, die sinking and profiling machines. A large number of half-tone illustrations of these machines are given.

The Comforts of Travel.—The Chicago, Milwaukee & St. Paul has just issued an 8½ x 11-in. booklet, printed on heavy paper, containing a large number of full-page half-tones, made from photographs of interiors, showing the traveling accommodations on the Pioneer Limited and the Southwestern Limited.

Flaming Arc Lamp; Interior Conduits.—The Western Electric Co., New York, has issued bulletin No. 5,532, which illustrates and describes the Victor flaming arc lamp. The special feature of this lamp is the absence of any mechanism for controlling the regulation of the arc, this being accomplished by the action of gravity as the carbons are burned away. This company is also mailing a leaflet which describes Galvaduct, an interior conduit for use in electrical work.

Electrical Apparatus.—The Crocker-Wheeler Co., Ampere, N. J., has just issued several bulletins describing electrical apparatus, including Bulletin No. 106, on d.c. switchboard

panels; Bulletin No. 107, which supersedes No. 80, on d.c. light and power generators; Bulletin No. 108, which supersedes No. 74, on engine type a.c. generators; Bulletin No. 109, which supersedes No. 71, on generating sets with type D engines, and Supplement No. 1 of Bulletin No. 95, on belt type a.c. generators.

Machine Tools, Manning, Maxwell & Moore, 1909, edition.—It is something like 30 years ago, as the writer recalls it, when Mr. Manning devoted a year's work and spent about $30,000 on the first edition of this remarkable trade catalogue. He always believed it to be the foundation of the firm's success as "distributors" of machine tools. This well may be true, for complete and useful information is probably more effective with buyers than is any of the forms of coaxing. This large quarto volume of 1,170 pages contains excellent engravings of 2,570 tools, with enough specification and description to make each item in the wonderful exhibit understandable. There are 154 tools shown, exclusively designed for railroad shop work, that is, not adapted to other shop work. They include wheel, axle and journal lathes, planers for everything from frogs to locomotive side rods, tire mills, wheel presses of many designs, drills of high duty and other duty, portable presses, pit jacks, flue welding furnaces and many other machines. These tools have a wide range in cost, from the $11,000 90-in. driving wheel lathe to the small cost flue cleaning machine, with a capacity for removing scale from 600 ft. of 2-in. tube per hour. The compiler of this catalogue is somewhat justified in naming it "an encyclopedia of machine tools," for, so used, it gives the information wanted. It is also informing to the general observer of the engineering skill shown in designing automatic tools, and adaptation to the economies resulting from high-speed steel and motor drives.

Steel Pole for Line Construction.

A new type of pole made by the Diamond Steel Pole Co., Philadelphia, Pa., of which the U. S. Metal & Manufacturing Co., New York, has recently become agent, is of square, tapered section formed from two flat tapered plates sheared from a rectangular piece of metal. These tapered plates, after being flanged along the edges, are troughed along the center line, the result being a tapered, flanged trough or angle section. Two of these sections are then forced together longitudinally, forming a square hollow pole with two weather proof joints. The pole is symmetrical throughout, has no transverse joints and, it is said, will not telescope. It may also be made in any desired taper. This design permits of considerable deflection without permanent setting. By using a 30-in. cast iron steel sleeve over the base of the pole, this sleeve extending 18 in. into the ground, rusting at the base of the pole is prevented. Cross-arms or other fittings cannot slip or turn and can be made to fit any requirements. These poles are intended for signal, telegraph, electric lighting, electric railroad service, etc.

Westinghouse Motor Friction Brake.

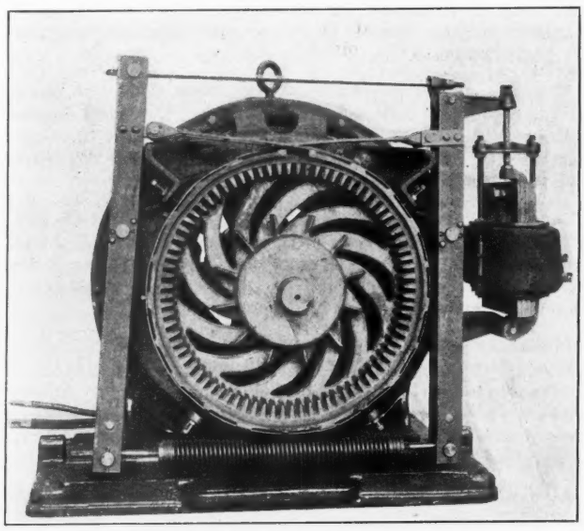
In many applications of electric motor drive the quick and accurate stops necessary could not be made without the use of suitable brakes. These also serve to prevent accidents by automatically stopping and holding the load in case of failure of the current supply. A number of magnetically operated d.c. motor brakes have been designed, but electro magnets, using alternating current, require, it is said, a considerably greater expenditure of energy for a given braking effect than those using direct current, and that the fly-wheel effect of the rotors of a.c. motors is greater than that of d.c. motors of corresponding capacity. As the magnet core must be laminated when alternating current is used, the cost of construction is thus increased.

A type of a.c. brake operated by electro magnets, which is said to overcome these difficulties, has just been placed on the market by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. This brake is characterized by simplicity and strength in construction and reliability in action. It is self-contained, readily applied and easily adjusted.

This brake, the PB type, is intended for use on Westinghouse two and three-phase induction motors of from 5 to 100 h. p., 25, 40 and 60 cycles. The braking action depends on the contraction of a coiled steel spring.

The advantage of this construction is that the brake will operate equally well with the motor tilted at a considerable angle, as on roller lift drawbridges. The cast iron brake shoes are held against the brake wheel by steel bands. The two vertical brake beams are connected at the top by a tie rod and at the bottom by a coiled steel spring. A polyphase solenoid-operating magnet is attached to the brake beams by a lever. The brake bands being attached to the beams above the pivots, the spring tends to draw the lower ends of the beams together, thus drawing the band and shoe against the wheel.

The friction of the wheel against the shoes tilts the beams through a small angle until they strike against lugs on the frame work. These lugs are above the pivots and so placed that when the beams press against them the tops are separated and the brakes more firmly set

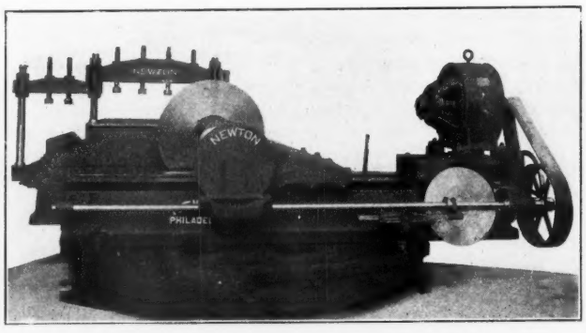


Westinghouse Motor Friction Brake.

by the motor itself. A very heavy braking action is thus obtained with a comparatively light spring and magnet. When the motor is operating, the current passes through the coils pulling the core down, releasing the brake. On stopping the motor the brake circuit is opened, allowing the spring to contract and apply the brake.

Rotary Planing and Sawing Machine.

The accompanying illustration shows a type of combined rotary, planing and sawing machine recently developed by the Newton Machine Tool Works, Inc., Philadelphia, Pa. This machine is designed to meet requirements of work on structural steel shapes. This machine is of the spindle driven type. The rotary planing head is mounted on a saddle of large proportions which insures rigidity and freedom from shattering. The main driving gear, of hammered steel, is placed between the two spindle bearings, intending to divide the strain between them. This main gear is driven through intermediate spur gears and a worm and worm wheel by a 6-in. face pulley, which latter is belt connected to the motor. The worm ring is of bronze and the worm of hardened steel, both of which run in oil. The steep pitch of the teeth gives suitable periphery speed to the saw blade with a comparatively slow speed to the worm, which feature it is claimed



Newton Rotary Planing and Sawing Machine.

has proven superior to any other in the practical application of worm and worm wheel drive. The saddle, or carriage, has an automatic friction feed variable up to 1½ in. per minute, with an adjustable automatic and positive safety release. The T-slots are cut in solid metal. A lateral hand adjustment is provided for setting the girders, I-beams and H-columns when finishing to exact lengths. The auxiliary table and V-block shown are provided for holding angles, stiffeners and irregular shapes. These machines are furnished stationary or mounted on a circular base, with hand or power adjustment, as shown in the accompanying illustration.